NUCLEAR SCIENCE ABSTRACTS

Volume 11 July 15, 1957 No. 13

GENERAL

ATOMIC BOMBS AND WARFARE

6593 AEC-tr-2903
MILITARY USE OF ATOMIC ENERGY. An. N. Nesmeyanov. Translated from Chap. V, p.92-107 in Radioactive Elements and Their Application (Radioaktivnyye Elementy i ikh Primeneniye), Military Publishing House, Ministry of Defense, (Moscow), 1955. 17p. (F-TS-8776/V).

ATOMIC POWER

6594 AERE-Lib/L-1
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
SOURCES OF INFORMATION IN ATOMIC ENERGY. L. J. Anthony. Nov. 23, 1956. 19p.

BIOLOGY AND MEDICINE

6595 CF-57-2-3
Oak Ridge National Lab., Tenn.
SPECTROGRAPHIC ANALYSIS OF NORMAL HUMAN TISSUE FROM DALLAS, TEXAS. I. H. Tipton, M. J. Cook, R. L. Steiner, J. M. Foland, K. K. McDaniel, and S. D. Fentress. Feb. 28, 1957. 51p. Contract [W-7405-eng-26]. $9.30(ph OTS); $3.60(mf OTS).

Normal human tissues were analyzed spectrographically for the presence of certain elements. Tabulated data are arranged by elements and by tissues. (C.H.)

RADIATION EFFECTS

6596 UCSF-14
California. Univ., San Francisco. School of Medicine. Radiological Lab.
SEMIANNUAL REPORT FOR PERIOD ENDING DECEMBER 31, 1956. Feb. 1957. 21p. Contract AT-11-1-GEN-10, Project No. 2. $0.25(OTS).

Data are presented on the calorimetric recalibration of the 70-Mv x-ray beam from the synchrotron; development of a chemical x ray dosimeter; the relative biological effectiveness of various energies of x radiation for a variety of test organisms; the influence of age and strain on the radiosensitivity of mice; the LD_{50} for rats exposed to x radiation; and methods for the enumeration of blood platelets. The skin response of cancer patients treated with the synchrotron x-ray beam is discussed. A list of publications during the period is included. (For preceding period see UCSF-13.) (C.H.)

6597 UR-483
Rochester, N. Y. Univ. Atomic Energy Project.
THE EFFECT OF HIGHLY IRRADIATED FOOD MEDIUM ON LIFE SPAN AND DEVELOPMENT OF DROSOPHILA MELANOGASTER. Betty Jo Henderson, R. C. Baxter, and L. W. Tuttle. Mar. 26, 1957. 86p. Contract W-7401-Eng-49. $13.80(ph OTS); $4.80(mf OTS).

Five successive generations of Drosophila melanogaster were grown on a brewers yeast medium irradiated with one million rep of γ rays from a Co^{60} source. The irradiation dose selected lies between the pasteurizing dosage range and the so called sterilizing dose for most microorganisms. Studies of longevity, fecundity, egg hatchability and body weights of several thousand flies disclosed no significant detrimental changes in the characteristics studied when evaluated at the 95% significance level. If toxic substances are produced in an aqueous yeast suspension by the application of 10^6 rep of γ radiation the concentrations are such that no deleterious effects are grossly evident in flies grown solely on irradiated medium for several generations. (auth)

6598 UR-486
Rochester, N. Y. Univ. Atomic Energy Project.
SOME EFFECTS OF VARIATION IN EXPOSURE TIME AND INPUT PULSE SHAPE IN THE PRODUCTION OF RADIANT ENERGY THERMAL BURNS. F. W. Payne and J. R. Hinshaw. Mar. 21, 1957. 25p. Contract W-7401-eng-49. $0.25(OTS).

6599
A CLINICAL STUDY OF RADIATION CATARACTS AND THE RELATIONSHIP TO DOSE. George R. Merriam and Elizabeth F. Focht (Memorial Center and Columbia-Presbyterian Medical Center, New York). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 77, 759-85 (1957) May.

6600
RADIOIRON TRACER STUDIES FOR THE EVALUATION OF RADIATION DAMAGE. R. Kenneth Loeffler (Temple Univ. Medical School and Hospital, Philadelphia). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 77, 836-46 (1957) May.

6601
THE EFFECT OF ROENTGEN-RAY QUALITY ON BONE GROWTH AND CORTICAL BONE DAMAGE. Leonard Rosenthal and James F. Marvin (Univ. of Minnesota Hospitals, Minneapolis). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 77, 893-8(1957) May.

6602
MORTALITY OF RHESUS MONKEYS AFTER SINGLE TOTAL BODY IRRADIATION. Ulrich K. Henschke and Joseph L. Morton. Am. J. Roentgenol. Radium Therapy Nuclear Medicine 77, 899-909(1957) May.

6603
CHANGES IN SERUM ALBUMIN ON IRRADIATION BY GAMMA RAYS IN VITRO AND IN VIVO. Ya. A. Epshtein and E. A. Zabozlaeva. Biochemistry (U.S.S.R.) 21, 515-19 (1956) July-Aug.

6604
ENHANCEMENT OF PROTECTIVE PROPERTIES OF ANTITETANUS SERUM AFTER ITS IRRADIATION WITH X-RAYS. R. V. Petrov. Bull. Exptl. Biol. Med. (U.S.S.R.) 41, 425-7(1956) May.

6605
CYTOLOGICAL ANALYSIS OF X-RAY-INDUCED MUTATIONS AT EIGHT SPECIFIC LOCI IN THE THIRD CHROMOSOME OF DROSOPHILA MELANOGASTER. Calvin L. Ward and Mary L. Alexander (Oak Ridge National Lab., Tenn., Duke Univ., Durham, N. C., and Univ. of Texas, Austin). Genetics 42, 42-54(1957) Jan.

6606

PROMPT PULMONARY VENTILATION AND OXYGEN CONSUMPTION CHANGES IN RHESUS MONKEYS ASSOCIATED WITH WHOLE-BODY GAMMA-IRRADIATION. Phillips M. Brooks, Everett O. Richey, and John E. Pickering (Randolph Air Force Base, Texas). Radiation Research 6, 430-49(1957) Apr.

The respiration in rhesus monkeys given whole-body irradiation at a dose rate of 1000 r/min in doses of 1000 r, 2500 r, 5000 r, 10,000 r, and 30,000 r from a Ba^{140}-La^{140} source was followed for 100 minutes from start of exposure. Data are tabulated and results discussed. (auth)

6607

A FORMULA FOR CHRONIC RADIATION DOSAGE VERSUS SHORTENING OF LIFE SPAN: APPLICATION TO A LARGE MAMMAL. D. J. Mewissen, C. L. Comar, Bernard F. Trum, and John H. Rust (Oak Ridge Inst. of Nuclear Studies, Tenn.). Radiation Research 6, 450-9(1957) Apr.

An equation has been developed relating life shortening to dosages of chronic whole-body irradiation and applicable to large mammals even when short survival times are observed. It is based on an analysis of the kinematics of injury. Transformation of latent injury into actual injury at a certain measurable rate was postulated to account for the so-called wasted radiation. Radiation damage was assumed to consist of a reparable and an irreparable portion. Numerical values for the parameters were computed from experimental data on chronic and acute irradiation of mammals. Application of this formula was made to data on chronic whole-body irradiation of the burro. The exponential dose-survival curve could be accounted for by a linear dose-damage relationship. An acute lethal dose of 660 r was calculated for the γ-irradiation of burros. (auth)

6608

COMPARATIVE MORTALITY AFTER 24-HOUR, WHOLE-BODY EXPOSURES OF MICE TO FISSION NEUTRONS AND COBALT-60 GAMMA-RAYS. Howard H. Vogel, Jr., John W. Clark, and Donn L. Jordan (Argonne National Lab., Lemont, Ill.). Radiation Research 6, 460-8(1957) Apr.

6609

RELATIVE BIOLOGICAL EFFECTIVENESS OF TRITIUM BETA-PARTICLES AND Co^{60} GAMMA-RAYS MEASURED BY LETHALITY IN CF1 MICE. John E. Furchner (Los Alamos Scientific Lab., N. Mex.). Radiation Research 6, 483-90(1957) Apr.

6610

THE OCCURRENCE OF MAMMARY TUMORS IN THE RAT AFTER SUBLETHAL WHOLE-BODY IRRADIATION. C. J. Shellabarger, E. P. Cronkite, V. P. Bond, and S. W. Lippincott (Brookhaven National Lab., Upton, N. Y.). Radiation Research 6, 501-12(1957) Apr.

6611

CIBA FOUNDATION SYMPOSIUM ON IONIZING RADIATIONS AND CELL METABOLISM. G. E. W. Wolstenholme and Cecilia M. O'Connor, eds. Boston, Little, Brown and Company, 1956. 328p.

RADIATION HAZARDS AND PROTECTION

6612 AECD-3763

Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies. STRONTIUM-90 CONCENTRATION DATA FOR BIOLOGICAL MATERIALS, SOILS, WATERS, AND AIR FILTERS. Project Sunshine Bulletin No. 11. E. A. Martell. Dec. 1, 1955. Decl. with deletions Nov. 30, 1956. Revised Jan. 1957. 67p. Contract [AT(11-1)-281]. $0.40(OTS).

Data obtained prior to Dec. 1, 1955 are presented for Sr^{90} analysis of samples of biological materials. Data are tabulated on bone, cheese, milk, fish, eggs, botanical samples, soil, air filters, and surface waters collected from various parts of the world. The data for biological and soil samples are presented in units of 1/1000 of the occupational tolerance dose of Sr^{90} for an average man of 1000 grams total-body content of Ca. Thus, the Sunshine unit equals 1/1000 μc of Sr^{90} per kilogram of Ca, or 2.2 disintegrations per min of Sr^{90} per gram of Ca. Results for water and air samples are reported in disintegrations per min of Sr^{90} per unit volume. (C.H.)

6613 AECU-3297(Rev.)

Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies. STRONTIUM-90 CONCENTRATION DATA FOR BIOLOGICAL MATERIALS, SOILS, WATERS, AND AIR FILTERS. Project Sunshine Bulletin No. 12. E. A. Martell. Aug. 1, 1956. Revised Jan. 1957. 70p. Contract [AT 11-1 -281]. $0.45(OTS).

Results obtained from Dec. 1955 to Aug. 1956 are presented for Sr^{90} analyses of samples of biological materials. Data are tabulated on fresh milk, cheese, soil samples, rain, snow, surface waters, air filters, and bones collected from various parts of the world. The data for biological and soil samples are presented in units of 1/1000 of the occupational tolerance dose of Sr^{90} for an average man of 1000 grams total-body content of Ca. Thus, the Sunshine unit equals 1/1000 μc of Sr^{90} per kilogram of Ca, or 2.2 disintegrations per min of Sr^{90} per gram of Ca. Results for water and air samples are reported in disintegrations per min of Sr^{90} per unit volume. (C.H.)

6614 NARF-56-47T

Convair, Fort Worth, Tex.

HEALTH PHYSICS ACTIVITIES [FOR] OCTOBER 1, 1955 TO SEPTEMBER 30, 1956. R. F. Shockley, W. R. Miller, and W. F. Cockrell, comps. and eds. Apr. 2, 1957. 135p. Project 6-(1-9964). Contract AF33(600)-32054. (3-R-81).

Health physics activities for the period are summarized. Data are presented from the following: a continuous evaluation of the levels of radioactivity in the environs; routine and special physical examinations of all employees normally exposed to radiation; routine and special measurements of the levels of radioactivity in controlled and uncontrolled areas; and routine and special monitoring of personnel working in controlled areas. (For preceding period see NARF-56-4T.) (C.H.)

6615 NEL-663

Navy Electronics Lab., San Diego, Calif.

A THEORETICAL STUDY OF ATMOSPHERIC DIFFUSION WITH APPLICATIONS TO FALLOUT FROM ATOMIC CLOUDS. J. J. Marciano. Feb. 17, 1956. 29p.

Methods and equations are developed for determining time of arrival, cumulative dose, total dose, and fallout area for gaseous and solid debris diffusing from sources resembling atomic clouds in shape. One of the solutions is an improvement over previous approaches along the same line, another solution presented is believed to be new, while a third is based on an improved equation whose value in this application has been overlooked before. Although the solutions appear mathematically formidable, they are readily subject to graphic presentation and application. (auth)

6616

IT'S TIME TO LOOK AT NUCLEAR MERCHANT SHIP SAFETY. R. A. Fayram and H. J. Schneider (Aerojet-General Nucleonics, San Ramon, Calif.). Nucleonics 15, No. 5, 109-11(1957) May.

The possibility of marine accidents occurring which would result in water contamination is discussed. Rough calculations as to the extent of the radiation hazard and recommendations for safety precautions are included. (T.R.H.)

6617
INFLUENCE OF SPLEEN HOMOGENATE INJECTION ON POSTIRRADIATION INFECTION. Myron S. Silverman, Vivian Greenman, Marie Ellis, and Leonard J. Cole (U. S. Naval Radiological Defense Lab., San Francisco, Calif.). Radiation Research 6, 474-82(1957) Apr.

Injection of isologous spleen homogenate shortly after exposure to a lethal dose of x rays resulted in decreased mortality of the exposed mice. This was accompanied by a decrease in the incidence of postirradiation infection with the normal enteric bacteria during the first 10 postirradiation days. Although the number of mice from which bacteria were isolated increased during the latter portion of the second postirradiation week, there was no increase in the number of deaths. This suggests that with regeneration of the hematopoietic tissues sufficient recovery of the body defense mechanism against infection had occurred to enable the animals successfully to combat the invading organism. (auth)

6618
STRONTIUM-90 IN MAN. Ralph E. Lapp. Science 125, 933-4(1957) May 10.

Biological hazards from fall-out Sr^{90} following nuclear explosions are discussed. (C.H.)

6619
PROTECTION AGAINST X-IRRADIATION BY 3-AMINO-1, 2,4-TRIAZOLE. Robert N. Feinstein and Sara Berliner (Argonne National Lab., Lemont, Ill.). Science 125, 936 (1957) May 10.

6620
RADIATION INJURY AND PROTECTIVE MEASURES FOR MEDICAL USE OF RADIOISOTOPES. Hedi Fritz-Niggli. Strahlentherapie 102, 355-69(1957) Mar. (In German)

The report presents a discussion on the physical and biological fundaments of injuries due to incorporated radioisotopes. The statements are based on clinical and experimental examples. The necessary protective measures are explained. The tolerance doses have been set up in conformance with the special literature. (auth)

RADIATION SICKNESS

6621
CHANGES IN ANTIGENIC PROPERTIES OF TISSUES OF WHITE RATS IN RADIATION SICKNESS. R. B. Petrov and L. I. Ilyina. Bull. Exptl. Biol. Med. (U.S.S.R.) 41, 345-8(1956) Apr.

RADIOTHERAPY

6622
RADIATION THERAPY IN THE TREATMENT OF RETINOBLASTOMA. Ivor G. Williams (St. Bartholomew's Hospital, London). Am J. Roentgenol. Radium Therapy Nuclear Medicine 77, 786-95(1957) May.

6623
COBALT 60 THERAPY OF LIP CANCER WITH BLOCK DISSECTION OF LYMPH NODES. J. Ernest Breed and Walter W. Carroll (Northwestern Univ. Medical School, Chicago). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 77, 815-17(1957) May.

6624
A STUDY OF METHODS FOR INTERSTITIAL IMPLANTATION OF RADIOACTIVE MATERIALS. II. FILAMENTS CONTAINING Y^{90}. H. C. Dudley, Joseph Greenberg, and S. S. Sarkisian (U. S. Naval Hospital, St. Albans, N. Y.). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 77, 852-60(1957) May.

6625
A Co^{60} INSTRUMENT FOR HALF-DEEP AND DEEP THERAPY. Erich Zdansky. Strahlentherapie 102, 422-4 (1957) Mar. (In German)

The author describes a Co^{60} apparatus containing two preparations of 30 and 300 C respectively. These preparations can be transported from the radioprotective receptacle into the application head, which allows to use the apparatus for half-deep as well as deep therapy. (auth)

6626
CLINICAL USE OF RADIOISOTOPES. William H. Beierewaltes, Philip C. Johnson, and Arthur J. Solari. Philadelphia, W. B. Saunders Company, 1957. 469p.

TRACER APPLICATIONS

6627
CORRELATION OF IODINE 131 CLEARANCE RATE FACTORS WITH CARDIAC FUNCTIONAL STATUS, PROTEIN-BOUND-IODINE PLASMA VALUES, AND BLOOD NON-PROTEIN NITROGEN. I. Meschan and T. H. Oddie (Bowman Gray School of Medicine, Winston-Salem, N. C.) and James T. Wortham, J. E. Doherty, and Elvis Little (Univ. of Arkansas School of Medicine, Little Rock). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 77, 847-51(1957) May

6628
RADIOACTIVE TRACER STUDY OF SEWAGE FIELD IN SANTA MONICA BAY. Ralph L. Ely, Jr. (Nuclear Science and Engineering Corp., Pittsburgh). IRE Trans. Nuclear Sci. NS-4, 49-50(1957) Mar.

In a unique experiment just completed in Santa Monica Bay, Calif., radioactive isotopes were successfully used to trace dispersion of sewage effluent in ocean waters. The results help to establish proper design procedures to insure against beach pollution in a current expansion of the Los Angeles sewage system. To effect the experiment twenty curies of scandium-46 were mixed with sewage effluent and discharged into the sea. Scientists aboard a laboratory ship then took radioactive measurements over a wide area to determine dilution rate and direction of diffusion. (auth)

6629
THE IMPORTANCE OF RADIO ISOTOPE RESEARCH IN MEDICINE AND BIOLOGY. Georg v. Hevesy. Strahlentherapie 102, 341-54(1957) Mar. (In German)

6630
A NEW RADIOIRON EXCHANGE METHOD FOR THE CLINICAL DIAGNOSIS OF DISTURBANCES IN IRON METABOLISM. Wolfgang Horst and Herbert Villanueva-Meyer. Strahlentherapie 102, 398-406(1957) Mar. (In German)

CHEMISTRY

6631 AECU-3436
Wisconsin. Univ., Madison.
THE KINETICS OF THE REACTION OF SULFITE AND BROMATE. Frank S. Williamson and Edward L. King. [1957]. 15p. Contract [AT(11-1)-64, Project No. 3]. $3.30 (ph OTS); $2.40 (mf OTS).

The oxidation of S^{4+} by bromate results, very largely, in the formation of sulfate; a deviation of the stoichiometry from that corresponding to sulfate production suggests the formation of a small amount of S^{5+}, presumably dithionate ion. The rate of disappearance of S^{4+} has been determined over the pH value ranges 3.4-7.4 at 25°C and 1.7-4.5 at

0°C. The rate data indicate that in the pH range studied the reaction proceeds via two different transition states with the compositions $[HSO_3 \cdot BrO_2^- + n\ H_2O]^{\ddagger}$ and $[SO_2 \cdot BrO_2^- + m\ H_2O]^{\ddagger}$. (auth)

6632 UCRL-3714

California. Univ., Berkeley. Radiation Lab.
THE CONTROL OF MERCURY VAPOR IN LABORATORIES. C. R. Wintersteen. Mar. 6, 1957. 11p. Contract W-7405-eng-48. $0.15(OTS).

The problem of mercury vapor in laboratories need not be a serious one if the basic precautions are taken. The following program is recommended as adequate and practical for the typical research laboratory: make sure that good ventilation is available at all times; clean up spills as soon as possible, preferably by use of an approved vacuum cleaner; use an electronic detection device for monitoring work areas and equipment; use vapor-suppressive chemicals when necessary; make sure that the correct personal protective equipment is available; and establish a safety procedure and stress the importance of Hg vapor control by the use of safety bulletins and other printed material. (auth)

6633 WIS-OOR-15

Wisconsin. Univ., Madison. Naval Research Lab.
A GENERALIZED EQUATION OF STATE FOR BOTH GASES AND LIQUIDS. I. NEW AND IMPROVED. J. O. Hirschfelder, R. J. Buehler, H. A. McGee, Jr., and J. R. Sutton. [1956?]. 68p. DA Project No. 599-01-004.

An equation of state for pure substances is presented which covers the full range of gases and liquids. (W.L.H.)

6634 AEC-tr-2506

OXIDATION OF THE WALLS OF A CARBON CHANNEL IN CONDITIONS OF FORCED DIFFUSION OF OXYGEN. O. A. Tsukhanova. Translated from Zhur. Tekh. Fiz. 9, 295-304(1939). 11p.

6635 AEC-tr-2904

A METHOD OF DETERMINING THE KINETIC CHARACTERISTICS OF AN EXOTHERMIC HETEROGENEOUS REACTION. N. Ya. Buben. Translated from Zhur. Fiz. Khim. 19, 250-2(1945). 6p.

Calculations are presented of the region of critical temperatures and the kinetic characteristics for a heterogeneous reaction of arbitrary order and energy of activation. (W.L.H.)

6636 AEC-tr-2906

THE ELECTRICAL CONDUCTIVITY AND THE TYPE OF BONDING IN THE ALKALI CARBIDES. A. von Antropoff and J. Fr. Müller. Translated by F. Hudswell from Z. anorg. u. Allgem. Chem. 204, 305-14(1932). 13p.

Conductivity measurements with alternating current on Na_2C_2 between 180 and 270° showed a behavior which is typical of ionic conductors. The values can be represented very well by the formula of Rasch and Hinrichsen and of Smekal. Experiments with direct current on Na_2C_2 also showed phenomena typical of ionic conductors: formation of dendrites and polarization. By applying Tubandt's AgI method for the prevention of dendrite formation it could be established that transport of electricity in Na_2C_2 is in accord with Faraday's law and is exclusively due to the Na^+. Mixtures of Li_2C_2 and acetylide showed a behavior very similar to that of Na_2C_2, and thus Li_2C_2 also must be regarded as an ionic conductor. The experiments confirm that the carbides of the alkali metals which we have studied are salt-like compounds. (auth)

6637 UCRL-Trans-301

SYNTHETIC STUDIES ON GLUCURONIC ACID DERIVATIVES. I. THE SYNTHESIS OF ARYL-β-D-GLUCOPYRANOSIDURONIC ACIDS. Hisao Tsukamoto, Masatomo Hamana, Keitaro Kato, and Takeshi Kuroda. Translated from J. Pharm. Soc. Japan 76, 1282-7(1956). 13p.

6638

A GENERAL DISCUSSION ON THE PHYSICAL CHEMISTRY OF PROCESSES AT HIGH PRESSURES HELD AT UNIVERSITY OF GLASGOW ON 20-21 SEPTEMBER, 1956. Discussions Faraday Soc. No. 22, 1956. 226p. 50s.

The subject matter is divided into sections on: equations of state, physical properties, thermodynamic transformations; chemical reactions and transformations at high pressures; and detonation and other high temperature phenomena at high pressures. Twenty-five papers are presented and discussed. (T.R.H.)

6639

NITRIC ACID DISSOLUTION OF THORIUM. KINETICS OF FLUORIDE-CATALYZED REACTION. Robert Lee Moore, C. A. Goodall, J. L. Hepworth, and R. A. Watts, Jr. (Hanford Atomic Products Operation, Richland, Wash.). Ind. Eng. Chem. 49, 885-7(1957) May.

The penetration rate of Th metal by boiling HNO_3 was measured as a function of the concentrations of acid, fluoride catalyst, and dissolved Th. The fluoride concentration was the most important variable, the dissolving rate in 13M HNO_3 increasing from 1 mg per hour per sq cm in the absence of fluoride to over 10,000 mg per hour per sq cm at 0.1M fluoride. The rate also increased with increasing nitric acid and reached a maximum at about 13M. Dissolved Th inhibited the reaction, presumably by complexing the free fluoride. Aluminum had a similar effect. The dissolution rate of thoria was found to be much less than that of Th. "Integral" dissolvings were also made, and an empirical mathematical equation was derived to correlate these results and facilitate application. (auth)

6640

DIMORPHIC MODIFICATIONS OF BERYLLIUM DIIODIDE, BeI_2. Rowland E. Johnson, E. Staritzky, and R. M. Douglass (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 79, 2037-9(1957) May 5.

Two polymorphic modifications of beryllium diiodide have been found. Form I apparently corresponds to the previously described phase, and form II is a heretofore undescribed high-temperature phase stable above 350°. Form I is tetragonal. Powder x-ray diffraction data indicate cell dimensions $a_0 = 6.12 \pm 0.01$ A., $c_0 = 10.63 \pm 0.02$ A., $Z = 4$. Form II is orthorhombic with cell dimensions $a_0 = 16.48 \pm 0.02$ A., $b_0 = 16.702 \pm <0.01$ A., $c_0 = 11.629 \pm <0.01$ A., $Z = 32$. Volume per formular unit and Lorentz-Lorenz refraction, respectively, of the two forms are nearly identical. (auth)

6641

CHEMISTRY OF THE GROUP VB PENTOXIDES. VI. THE POLYMORPHISM OF Nb_2O_5. Frederic Holtzberg, Arnold Reisman, Margaret Berry, and Melvin Berkenblit (Columbia Univ., New York). J. Am. Chem. Soc. 79, 2039-43 (1957) May 5.

The polymorphism of Nb_2O_5 has been reinvestigated. Experimental results indicate the definite existence of two modifications and the possible existence of a third. The δ-modification recently reported has been shown to be a poorly crystallized state of the γ-phase. It is proposed that the α- and β-phases are identical, with the β-modification existing as a two-dimensional array. Transformation temperatures were found to be: amorphous to γ 435°, γ to α 830°. The densities are: amorphous 4.36 g./cm.^{3} at 25°, γ, 5.17 g./cm.^{3} at 25° and α, 4.55 g./cm.^{3} at 25°. None of the transformations was reversible. The α-phase was reindexed on the basis of a monoclinic unit cell with a = 21.34 A., b = 2.816 A., c = 19.47 A. and ∢ β = 120°20′ having 14

molecules/unit cell and an x-ray density of 4.52 g./cm.^{3}. The freezing point of Nb_2O_5 obtained in the study was 1491°. (auth)

6642

ON THE SOLUBILITY OF Ag_2SO_4 IN VARIOUS ELECTROLYTE MEDIA. EFFECTS OF THE SOLUBILITY OF Ag_2SO_4 AND AgCl ON THE Ag, Ag_2SO_4 AND THE Ag, AgCl ELECTRODES. M. H. Lietzke and R. W. Stoughton (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 79, 2067-71(1957) May 5.

The log of the solubility products of Ag_2SO_4 on a molality basis in KNO_3, $AgNO_3$, $Mg(NO_3)_2$, $Al(NO_3)_2$, Na_2SO_4, $MgSO_4$, $CuSO_4$, $Al_2(SO_4)$, $La_2(SO_4)_3$ and $In_2(SO_4)_3$ media were plotted against the stoichiometric ionic strength. The curves were unexpectedly similar. The solubility of AgCl in HCl and $AgNO_3$ solutions was interpreted in terms of the mononuclear complexes $AgCl_2^-$, $AgCl_3^{2-}$, $AgCl_4^{3-}$ and Ag_2Cl^+, Ag_3Cl^{2+}, Ag_4Cl^{3+}, respectively. Possible effects of increased solubility of the silver salts on the usefulness of the Ag, Ag_2SO_4 and Ag, AgCl electrodes are mentioned. (auth)

6643

THE PYROLYSIS OF LEAD OXALATE; ISOTOPE EFFECTS AND PRODUCT COMPOSITION. Peter E. Yankwich and James L. Copeland (Univ. of Illinois, Urbana). J. Am. Chem. Soc. 79, 2081-6(1957) May 5.

The composition and isotopic constitution of the gaseous products of the pyrolysis of lead oxalate have been studied for reaction between 350 and 625°. Variations with temperature of the ratio of carbon dioxide to carbon monoxide in the product gases and of carbon isotope distribution are considered in terms of simple models in which: (a) it is assumed that the primary products are modified by a secondary reaction among themselves which competes with escape of the gaseous products from the decomposing mass, or (b) oxygen abstraction and C−C bond rupturing processes are presumed to compete. Models in group (a) are shown to correspond to temperature dependences of the molar yield ratio of gaseous products which are not in accord with observation. Consideration of models in group (b) is based primarily on the Bigeleisen−Wolfsberg treatment of three center reactions; satisfactory agreement is obtained for a model of the activated complex which includes a lead atom. (auth)

6644

A STUDY OF THE DECOMPOSITION OF p-NITROPHENETHYLTRIMETHYLAMMONIUM IODIDE BY MEANS OF THE HYDROGEN ISOTOPE EFFECT. Ernest M. Hodnett and John J. Flynn, Jr. (Oklahoma Agricultural and Mechanical Coll., Stillwater). J. Am. Chem. Soc. 79, 2300-2 (1957) May 5.

The hydrogen isotope effect in the decomposition of p-nitrophenethyl-β-t-trimethylammonium iodide in water at 100° has been measured. A hydrogen atom on the carbon adjacent to the ring is removed from a labeled molecule 7.4 times as rapidly as a tritium atom in the same position. A hydrogen atom in this same position in an inactive molecule is removed 15% faster than a hydrogen atom in the corresponding position of the labeled molecule. The existence of these differences in rate of reaction establishes the mechanism of the decomposition as being that of an attack on the hydrogen atom in the β-position to the ammonium group. (auth)

6645

GASEOUS DETONATIONS IN MIXTURES OF CYANOGEN AND OXYGEN. H. Milton Peek and R. G. Tharp (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 26, 740-5(1957) Apr.

Precise experimental data are compared with precise theoretical values for the detonation velocities of several gaseous mixtures of cyanogen and oxygen. The results of this comparison show that these detonation processes are pathological in the sense of the theory of Kirkwood and Wood. Because of the lack of chemical kinetic data, it is not possible to calculate correct detonation velocities for these pathological detonations. Therefore, the determination of detonation velocities is not a worthwhile method for the determination of precise values of thermodynamic properties in mixtures of cyanogen and oxygen. (auth)

6646

SHORT-RANGE INTERMOLECULAR FORCES. II. H_2-H_2 AND H_2-H. Edward A. Mason (Univ. of Maryland, College Park) and Joseph O. Hirschfelder (Univ. of Wisconsin, Madison). J. Chem. Phys. 26, 756-66(1957) Apr.

The energy of interaction between two H_2 molecules and between a H^- atom and a H_2 molecule are calculated using a new method for approximating the 3- and 4-center integrals. The results are in good agreement with previous calculations of Margenau and with existing experimental data. The multiple exchange and zeroeth order perturbation make our calculations somewhat complicated. Although good results were obtained by de Boer, who neglected these terms, the success of such a procedure depends on a fortuitous cancellation of errors. Following de Boer's procedure for the case of a hydrogen atom-hydrogen molecule interaction, we obtained very poor results. (auth)

6647

DYNAMIC COMPRESSION OF LIQUIDS FROM MEASUREMENTS ON STRONG SHOCK WAVES. John M. Walsh and Melvin H. Rice (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 26, 815-23(1957) Apr.

High explosives were used to drive strong shock waves into various liquids, and a moving-image camera was employed to determine velocities associated with the shock waves. The measured velocities are transformed to pressure-compression points by applying the conservation relations. The pressures attained vary among the 15 liquids studied but are typically in the range 50 kilobars to 150 kilobars. For water, more extensive experimentation suffices to determine the Hugoniot curve from 30 kilobars to 450 kilobars. The highest pressure for each of the liquids extends the available data range from static experimentation several fold. A shock-wave-reflection experimental method is described, the purpose of which is to measure the useful thermodynamic variable $(\Delta H/\Delta V)_p$ at high pressures. Results are given for water. Qualitative experiments to study the transparency of shocked water, carbon tetrachloride, ethyl alcohol, and benzene are reported. (auth)

6648

EQUATION OF STATE OF WATER TO 250 KILOBARS. Melvin H. Rich (Iowa State Coll., Ames) and John M. Walsh (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 26, 824-30(1957) Apr.

An equation of state for water, applicable in the pressure range 25 kilobars to 250 kilobars, is formulated in terms of experimental data obtained from shock wave measurements. This equation of state is used to calculate P-V relations for several adiabats and isotherms. Thermodynamic and hydrodynamic data along the Hugoniot curve are given as a function of shock pressure, and pressure-particle velocity relations for initial shocks followed by reflected shocks and rarefactions are given. (auth)

6649

ON THE THEORY OF OXIDATION-REDUCTION REACTIONS INVOLVING ELECTRON TRANSFER. II. APPLICATIONS TO DATA ON THE RATES OF ISOTOPIC EXCHANGE REACTIONS. R. A. Marcus (Polytechnic Inst.

of Brooklyn, N. Y.). J. Chem. Phys. 26, 867-71(1957) Apr.

The rates of some homogeneous isotopic exchange reactions in solution are considered in the light of a recently developed quantitative theory of redox processes. The relative importance of several factors influencing the rates of these reactions is discussed. These factors include the Coulombic repulsion between the ionic reactants and the extent of solvation of the ions. Free energies and entropies of activation of various reactions are calculated from the theory without the use of any adjustable parameters. The agreement with the experimental data is considered to be satisfactory. On the basis of the theory and of earlier experiments in heavy water an experimental method is tentatively suggested for distinguishing electron and atom transfer mechanisms. This method applies to halide-catalyzed exchange reactions of metal aquo-ions, and to other anion-catalyzed reactions of this type not involving breakable OH bonds. (auth)

6650

SELECTIVE SOLVATION AND DIELECTRIC SATURATION AS RELATED TO ELECTRON EXCHANGE REACTIONS. Edward S. Amis (Univ. of Arkansas, Fayetteville). J. Chem. Phys. 26, 880-1(1957) Apr.

The Np(V)–Np(VI) electron exchange reaction has been found to be independent of the composition and of the gross properties, dielectric constant, refractive index, viscosity, etc., of two mixed solvents. To account for these phenomena, the critical complex is assumed to consist of a region containing the reactant ions and the solvent component of highest dielectric constant. This component preferentially solvates the ionic reactants. In this region, complete dielectric saturation is also assumed. (auth)

6651

MODIFICATIONS OF THE Cs ABSORPTION SPECTRUM DUE TO INTERATOMIC INTERACTIONS. Oleg Jefimenko and Shang-Yi Ch'en (Univ. of Oregon, Eugene). J. Chem. Phys. 26, 913-19(1957) Apr.

Absorption spectra of Cs in the presence of H_2, D_2, N_2, He, Ne, A, Kr, Xe, methane, ethane, propane, n-butane, n-pentane, n-hexane, n-heptane, n-octane, and benzene were investigated following a similar work with Rb. It was found that the spectra of all these mixtures of Cs and foreign gas exhibit diffuse bands in the neighborhood of certain Cs atomic lines. Over one-hundred such bands were identified, the positions of the bands were measured, and some of the regularities in the occurrence of the bands were determined. The results of this investigation in general were found to be in qualitative agreement with the statistical theory of pressure broadening of the atomic lines if both the attractive and the repulsive interatomic forces are taken into account. It is, however, not certain that the statistical theory is capable of explaining the observed phenomena in their entirety. (auth)

6652

TRANSFERENCE IN BINARY MOLTEN SALT SOLUTIONS. Benson Ross Sundheim (New York Univ., New York). J. Phys. Chem. 61, 485-6(1957) Apr.

The coupling between diffusion and electrical conduction is treated for a solution of two molten salts having an ion in common. The quantities of transport are related to transference numbers, diffusion potential and the steady state in electrolysis. (auth)

6653

THERMODYNAMIC FUNCTIONS FOR THE ISOTOPIC HYDROGEN SELENIDES AND HYDROGEN TELLURIDE. A. P. Altshuller. J. Phys. Chem. 61, 509-11(1957) Apr.

Calculations of the thermodynamic functions of H_2Se, HDSe, D_2Se, and H_2Te are given. (W.L.H.)

ANALYTICAL PROCEDURES

6654 AERE-I/M-35

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE RECOVERY OF Tl^{204} FROM OLD PLATING BATHS. H. Small. Sept. 29, 1954. 9p.

By using an ion exchange technique it has been possible to effect a fairly rapid recovery of Tl free of Cu and addition agents where other methods have been found less effective and more laborious. The procedure can be adapted easily to general problems in the reclaiming of Tl which would normally have to be discarded. (auth)

6655 CCC-1024-TR-232

Callery Chemical Co., Penna.

DETERMINATION OF HYDROXYLIC IMPURITIES IN METHYL BORATE BY INFRARED SPECTROPHOTOMETRY. D. R. Mackey, J. W. Brogan, H. J. Birch, and A. E. Weber — P. M. Maginnity, ed. Mar. 14, 1957. 13p. Contract [NOa(s)-52-1024-c].

Among the major impurities in methyl borate are those containing hydroxyl groups, particularly methanol and boric acid. The concentration of hydroxyl groups can be estimated with a precision of 0.04 milliequivalent per milliliter in the range of 0 to 0.5 milliequivalent per milliliter by quantitative infrared analysis. The methods used for establishing working curves are the base line method and area methods, in particular a new method, the relative integrated absorbance. (auth)

6656 NYO-4702

New York Operations Office. Health and Safety Lab., AEC.

SELECTED BIBLIOGRAPHY ON ANALYSIS OF CERTAIN RADIOACTIVE ELEMENTS IN BIOLOGICAL MATERIALS. David Revinson. Dec. 7, 1956. 19p. $0.20(OTS).

6657 Y-1152

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.

EDDY CURRENT ELECTRICAL CONDUCTIVITY MEASUREMENT AS AN ANALYSIS FOR MOLYBDENUM IN BINARY MOLYBDENUM–URANIUM ALLOYS. R. E. Cofield. Feb. 15, 1957. 32p. Contract W-7405-eng-26. $0.25(OTS).

The principles involved in a noncontact, electromagnetic induction or eddy current method of measuring the electrical conductivity of a solid are discussed and a simple Eddy Current Conductivity Meter is described. The problems involved in the conductivity analysis of binary alloys, including the general relationships between electrical conductivity and alloy structure, composition, and metallurgical conditions are discussed. The method has been used for the analysis of wt. % Mo in U–2 wt. % Mo alloys with agreement with chemical analysis of ±0.128 wt. % Mo. Such a method has many potential uses in analytical chemistry and metallurgy. (auth)

6658

THE DETERMINATION OF THORIUM AND LANTHANONS IN MONAZITE. J. Clinch and E. A. Simpson (Thorium Ltd., Ilford, Essex). Analyst 82, 258-69(1957) Apr.

The determination of thorium and lanthanons in monazite has been investigated. Oxalic acid is shown to be an unsatisfactory group precipitant because of solubility losses both of thorium and lanthanon oxalates. Precipitation with ammonium oxalate at a controlled acidity reduces these solubility losses to acceptable levels. A double precipitation with ammonium oxalate satisfactorily removes elements other than calcium from the thorium-lanthanon mixture, which can then be separated to permit thorium and lanthanons to be determined separately. Benzoic acid is a satisfactory precipitant for separating and determining

thorium in such a mixture. Lanthanons can be separated from calcium and determined by precipitation as hydroxides. By using these techniques, thorium and lanthanons have been determined in a sample of South African monazite with coefficients of variation of, respectively, 1 and 0.4 per cent. The results for lanthanon content are about 1 per cent low. (auth)

6659

SPECTROPHOTOMETRIC ESTIMATION OF URANIUM WITH TIRON. B. Sarma and C. P. Savariar (National Chemical Lab. of India, Poona). J. Sci. Ind. Research (India) 16B, 80-2(1957) Feb.

A spectrophotometric method for the estimation of semi-micro quantities of uranium up to 400 ppm has been described. Uranium forms a highly soluble brown complex with tiron (disodium catechol disulphonate). The color of the complex deepens with rise in the pH. The optical density of the complex shows a continuous increase with pH, but an absorption peak is observed at 373 mμ in the range 340 to 750 mμ when the solution is kept at pH 2 to 3.5. Absorbencies were measured at 373 mμ and pH 3. The complex obeys Beer's law perfectly under specified conditions. (auth)

DEUTERIUM AND DEUTERIUM COMPOUNDS

6660

SOLUBILITY OF HYDROGEN AND DEUTERIUM IN NONPOLAR SOLVENTS. M. W. Cook, D. N. Hanson, and B. J. Alder (Univ. of California, Berkeley). J. Chem. Phys. 26, 748-51(1957) Apr.

Data are presented for the solubility of H_2 and D_2 in eight nonpolar solvents from −25°C to 35°C, and show that D_2 is about 2.5% more soluble. The data are accurate to 0.1% and correlate successfully with the solubility parameter of the solvent. The various thermodynamic functions are calculated. (auth)

FLUORINE AND FLUORINE COMPOUNDS

6661 AECD-3690

Du Pont de Nemours (E. I.) and Co. Engineering Dept., Wilmington, Del.

METERING OF HF AND FLUORINE. Final Report on BPX-5. R. H. McBride. Oct. 29, 1945. Decl. Oct. 17, 1955. 48p. Contract [W-7402-eng-151]. (M-2488; CWC-ED-5). $0.30(OTS).

GRAPHITE

6662

ELECTRONIC BAND STRUCTURE IN GRAPHITE. Masatoshi Yamazaki (Yamagata Univ., Japan). J. Chem. Phys. 26, 930-4(1957) Apr.

The tight-binding approximation is applied to a study of graphite, using Slater atomic orbitals for the carbon atom with nuclear charge $2\delta = 3.18$. The 16×16 determinantal secular equation for the energy is reduced by a group-theoretical treatment of the spatial symmetry at certain special values of the wave vector k. The calculated results are that valence and conduction π bands overlap very slightly to each other at the corner points of the first Brillouin zone—at the wave vector $k = 2\pi(\frac{1}{2}c, \frac{3}{2}a, 0)$—, σ- and π-valence bands are separated, the σ and π band width is about 16 ev, 1 ev, respectively, and the ionization energy (work function) is about 9 ev. (auth)

Refer also to abstract 6862.

LABORATORIES AND EQUIPMENT

6663 AERE-C/R-779

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A USEFUL ELECTROLYTIC CELL. F. Hudswell, K. L. Wilkinson, and J. C. Waldron. Sept. 10, 1951. Decl. Mar. 4, 1957. 12p.

The electrolytic cell described is constructed from perspex, and can be used for obtaining electrodeposits on defined areas of one or both sides of a metal sheet or foil. Stirring is uniform on both sides of the foil, since the stirrers (usually the anodes) are geared together. The foil is held in a vertical plane to minimize the collection of loose particles. Provision is made for the removal of the electrolyte into an auxiliary chamber before interrupting the current. The cell is especially useful for the electrodeposition of radioactive materials from small volumes of solution. (auth)

6664 AERE-ES/R-2124

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

CALIBRATION OF THE MERCURY VAPOUR DETECTOR TYPE "B." P. E. Thorpe and R. W. Marriott. Jan. 1957. 16p.

6665

MIDGET HYDROCLONES REMOVE MICRON PARTICLES. P. A. Haas, E. O. Nurmi, M. E. Whatley, and J. R. Engel (Union Carbide Nuclear Co., Oak Ridge, Tenn.). Chem. Eng. Progr. 53, 203-7(1957) Apr.

The use of hydroclones, in removing 1-μ solid particles from aqueous solutions, was developed in order to supply a simple, durable, liquid-solid separation apparatus to remove precipitated fission and corrosion products from UO_2SO_4 solutions employed in homogeneous reactors. (W.L.H.)

6666

METAL SYSTEM FOR CHEMICAL REACTIONS AND FOR STUDYING PROPERTIES OF GASES AND LIQUIDS. H. V. Neher (California Inst. of Tech., Pasadena) and Satya Prakash (Physical Research Lab., Ahmedabad, India). Rev. Sci. Instr. 28, 267-70(1957) Apr.

An all-metal system, made of copper, is herein described. It is suitable for working with those chemicals which do not attack copper. In particular it has been found very useful in the purification of BF_3 and $B(CH_3)_3$. Some important features of such a system are (1) a complete absence of contaminants; (2) reactions may be carried out up to 500°C; (3) pressures up to several hundred pounds per square inch may be used; (4) flow of gases from very low to very high pressures may be easily controlled; (5) the system is very rugged. This latter point is particularly desirable where noxious or inflammable gases (such as $B(CH_3)_3$) are used. A method is also described whereby gases from sealed-off containers under either high or low pressures may be easily retrieved without introducing impurities. Other important advantages of such a system are mentioned in the text. (auth)

6667

REACTION BOMB FOR USE AT ELEVATED TEMPERATURES AND PRESSURES. Edwin M. Larsen and James J. Leddy (Univ. of Wisconsin, Madison). Rev. Sci. Instr. 28, 292-3(1957) Apr.

MOLECULAR STRUCTURE

6668

THE POSITIONS OF HYDROGEN ATOMS IN UREA BY NEUTRON DIFFRACTION. J. E. Worsham, Jr. (Univ.

of Richmond, Va.) and H. A. Levy and S. W. Peterson (Oak Ridge National Lab., Tenn.). Acta Cryst. 10, 319-23 (1957) Apr.

Neutron diffraction measurements of the h0l reflections from urea confirm that the H atoms are coplanar with the rest of the molecule. Unusually large amplitudes of thermal displacement were found. The apparent N–H distance, uncorrected for thermal effects, is 0.99 A, and the C–N–H angles are close to 120°. (auth)

RADIATION CHEMISTRY

6669

ALPHA-INDUCED DECOMPOSITION OF AMMONIA. II. EFFECTS OF VARIATIONS IN INTENSITY AND PRESSURE. Benjamin P. Burtt and Antoine B. Zahlan (Syracuse Univ., N. Y.). J. Chem. Phys. 26, 846-50(1957) Apr.

6670

THEORY OF RADIATION CHEMISTRY. IV. CHEMICAL REACTIONS IN THE GENERAL TRACK COMPOSED OF N PARTICLES. L. Monchick, J. L. Magee, and A. H. Samuel (Univ. of Notre Dame, Ind.). J. Chem. Phys. 26, 935-41 (1957) Apr.

The chemical reactions which occur in particle tracks are diffusion-controlled. In this paper a set of partial differential equations is presented which describes the dissipation of a track composed of N particles. These equations involve functions which can be interpreted as correlation functions for the relative distribution of the particles. A superposition approximation is introduced which greatly simplifies the equations and a method for obtaining the correlation functions is presented. As an example of application of these equations a model for the action of ionizing radiation on water is discussed. It is shown that the radiation chemistry of water is adequately described for reasonable values of the parameters of the model. (auth)

6671

IN VITRO LABILITY OF METHIONINE TO IONIZING RADIATIONS. U. S. Kumta, S. U. Gurnani, and M. B. Sahasrabudhe (Indian Cancer Research Centre, Bombay). J. Sci. Ind. Research (India) 16C, 25-9(1957) Feb.

The in vitro lability of methionine to radiations from radon sources has been investigated using samples of methionine-S^{35} and methionine-$C^{14}H_3$. It has been shown that one of the earliest events in the degradation of methionine is the severance of CH_3 grouping leaving a comparatively radio-stable homocysteine-like skeleton. However, with increase in the radiation dose, even S^{35} atoms are knocked off leaving amino acid-like compounds resembling threonine, aspartic acid, serine, glycine, etc. The probable pathways of oxidative degradation of methionine have been discussed. (auth)

6672

THE OXIDATION OF FERROUS AMMONIUM SULFATE SOLUTIONS BY ELECTRON IRRADIATION AT HIGH DOSE RATES. J. P. Keene (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Radiation Research 6, 424-9 (1957) Apr.

The G value for the oxidation of 3×10^{-3} M air-saturated ferrous ammonium sulfate solution in 0.8 N sulfuric acid by 4-Mev electrons has been measured at a dose rate of $\sim 10^{19}$ rads/sec. Energy input was measured calorimetrically, and total doses were sufficiently low to avoid complete absorption of dissolved oxygen. Three independent determinations were made, giving a mean value of 14.3 for G. (auth)

6673

THE INFLUENCE OF OXYGEN AND WATER ON THE AFTER-EFFECT IN CELLUOSE DEGRADATION BY GAMMA-RAYS. R. E. Glegg (Cornell Univ., Geneva, N. Y.). Radiation Research 6, 469-73(1957) Apr.

Refer also to abstracts 6603 and 6611.

RADIATION EFFECTS

6674 HDC-1876

Hanford Works, Richland, Wash.

PRELIMINARY RUBBER IRRADIATION TESTS. D. L. Peterson. Aug. 25, 1950. Decl. Apr. 19, 1957. 7p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The effects of irradiation tests on neoprene, "Hycar," and natural rubber are tabulated and discussed. The only conclusion reached was that none of these materials can be used for seals, flexible connections, or flexible shielding in high neutron flux areas. (T.R.H.)

6675 WADC-TN-55-181

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

DETERMINATION OF GAMMA RADIATION EFFECTS ON LINEAR POLYETHYLENE BY INFRARED ANALYSIS. Nora E. Srp. May 1955. Project No. 73602(A).

An infrared method for determining the chemical change in polyethylene caused by gamma radiation has been established using a double beam recording spectrophotometer. Important changes in the polymer were the formation of esters, trans unsaturation, and possibly crosslinking. Carbon and hydrogen analyses were also made on these materials. The method, calibration curves, infrared spectra, carbon and hydrogen data, and bibliography are given in an appendix. (M.H.R.)

6676

ELECTRON AND γ-RAY RADIOLYSIS OF n-HEXANE. H. A. Dewhurst and E. H. Winslow (General Electric Co., Schenectady, N. Y.). J. Chem. Phys. 26, 969-70(1957) Apr.

6677

IONIZATION OF ACETYLENE MIXTURES AND OTHER MIXTURES BY Pu^{239} α-PARTICLES. Harold J. Moe, T. E. Bortner, and G. S. Hurst (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 61, 422-5(1957) Apr.

The ionization produced when Pu^{239} α particles were completely absorbed in binary gas mixtures having acetylene as one of the components was measured. The W value (electron volts per ion pair) was computed from the known energy and the indirectly measured ionization for various percentages of the two gases in the mixture. The W values for varying proportions of a binary gaseous mixture were then compared to W_m as determined by the equation $1/W_m = (1/W_1 - 1/W_2)Z + 1/W_2$ where $Z = P_1/(P_1 + aP_2)$ and W_m is the W value for a mixture of two gases having partial pressures P_1 and P_2 and W values W_1 and W_2, respectively. Good agreement was found when the following values were used for the empirical constant "a": N_2–C_2H_2, 0.265; CO_2–C_2H_2, 0.927; CH_4–C_2H_2, 0.386; N_2–CH_4, 0.617; He–C_2H_2, 0.058; C_2H_2–A, 3.42; C_6H_6–A, 5.376; CH_4–A, 2.00. The W values for mixtures of neon with acetylene would not yield to this interpretation. (auth)

6678

MECHANISM OF HIGH ENERGY RADIATION EFFECTS IN POLYMERS. Robert Simha and Leo A. Wall (New York

Univ., New York and National Bureau of Standards, Washington). J. Phys. Chem. 61, 425-30(1957) Apr.

A series of elementary processes for cross-linking and scission reactions based on free radical intermediates in a homogeneous system are proposed. The kinetic evaluation under several approximations leads to expressions for the amounts of volatiles, unsaturation, cross-links and scissions as functions of time and intensity of radiation. The dependence of the rates on intensity is linear only in special cases. Isotopic substitution with deuterium should decrease the production of unsaturation. Hydrogen yield, on the other hand, can remain constant if certain conditions are fulfilled. The observed isotopic differences in polystyrene may indicate an additional step for the capture of atoms. This is suggested to occur through the phenyl ring. Qualitative considerations that seem to favor free radical over ion intermediates in polymers are mentioned. (auth)

SEPARATION PROCEDURES

6679 AERE-C/R-1537(Del.)

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE SEPARATION OF FISSION PRODUCTS BY ELECTROLYTIC PRECIPITATIONS. A. C. Littlejohn. Nov. 11, 1954. Decl. with deletions Dec. 19, 1956. 16p.

Experiments have been performed which show that those fission products forming insoluble hydroxides may be precipitated as such, leaving the principal long lived constituents Sr and Cs, together with Ba and Rb in solution. The precipitations were carried out electrolytically, an anion permeable membrane separating the electrode compartments of the cell in which the fission product solution was the catholyte. The important feature of this method is that the hydroxide precipitates were obtained without the addition of alkali. The results obtained using mock fission product solutions containing approximately two curies of activity per run, indicate that up to eighty five percent of the Cs and a similar proportion of the Sr remains in solution after precipitation of all other fission products, U and Fe. These figures suggest that the method may be utilized for the isolation of Sr and Cs for the preparation of radiation sources. (auth)

6680 CRDC-614

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

ELECTRODIALYSIS OF FISSION PRODUCT SOLUTIONS. R. W. Durham and P. D. Goulden. Mar. 1957. 19p. (AECL-437).

The recovery of HNO_3 by means of electrodialysis through anion exchange membranes has been investigated using TBP process waste fission product solutions. A continuous process using three cells has been devised. When operating under steady state conditions, the catholyte in the last cell has a pH of about 10 and a precipitate containing 80 to 90% of the original $\beta\gamma$ activity is formed. The supernatant solutions contains mainly cesium with some strontium and ruthenium. The recovered nitric acid contains about 3% of the initial $\beta\gamma$ activity. (auth)

6681 CRDC-687

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

AN IMPROVED FILTRATION SYSTEM FOR ASSAY OF RADIOACTIVE PRECIPITATES. R. E. Jervis. Jan. 1957. 10p. (AECL-428). $0.20(OTS).

Millipore molecular filter discs have been applied to the gravimetric assay of radioactive precipitates deposited by a filtration technique. Filter discs of this material are superior to filter paper discs for source preparation, and can result in a fivefold improvement in the precision of semi-micro analysis of source deposits. A readily assembled Teflon filtration apparatus for supporting the Millipore filter discs is described. (auth)

6682 NP-6276

Brussels. Centre D'Etudes Pour Les Applications de l'Energie Nucleaire.

ETUDE SUR LA PURIFICATION DU MELANGE (Zr–Hf) ET SUR LA SEPARATION (Zr–Hf). PART I. PURIFICATION DU MELANGE (Zr–Hf). (Study on the Purification of the Zr–Hf Mixture and on Zr–Hf Separation. Part I. Purification of the Zr–Hf Mixture). N. Isaac and R. De Witte. Sept. 13, 1955. 28p. (B-1).

An experimental study was made of the processes of the corrosion of the oxide and of the purification of the salts of Zr cited in the literature. Starting with technical oxide containing 3% Hf and other impurities, the following method was set up: treatment of the oxide by hot concentrated HCl to extract Fe, Al, and Cr; dissolution of the oxide in 80% boiling H_2SO_4 and separation of the silica; purification of the sulfate by crystallization of its $HCl-H_2SO_4$ solution; neutralizations by NH_4OH and dissolutions in 20% HCl repeated until the absence of SO_4^{--} ions; purification of the oxychloride by crystallization of its hydrochloric solution. (tr-auth)

6683 RMO-2622

Little (Arthur D.) Inc. Western Labs., San Francisco.

DEVELOPMENT OF A MODIFIED CHAR ADSORBENT FOR THE RECOVERY OF URANIUM FROM ORE SLURRIES. Summary Report. Paul Noble, Jr., E. P. Bullwinkel, W. I. Watson, R. A. Carlson, J. C. Huggins, and I. M. Whittemore. June 1956. 84p. Contract AT(49-6)-923. $0.45 (OTS).

A process for the recovery of U from dilute acid leach solutions and ore slurries is described. The novel process utilizes a C adsorbent modified with a chelating agent to produce an adsorbent active for U. Several organophosphorus compounds were found suitable as chelating agents for this process. A proposed flowsheet based on successful laboratory studies is presented and the chemistry and mechanism of the process are discussed. (auth)

6684 WIN-66

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

ALKALINE LEACH—FILTRATION PILOT PLANT TESTING OF U AND I ORE. A. W. Griffith, W. A. Millsap, and Guy Winslow. Jan. 28, 1957. 56p. Contract AT(49-6)-924. $9.30(ph OTS); $3.60(mf OTS).

Uranium ore from the Hecla Mining Company's Fortunate Claim and from the Hidden Splendor Mining Company's Farwest Claim was treated in the Alkaline Leach–Filtration Pilot Plant at Grand Junction, Colorado. The report contains detailed information on grinding, leaching, filtration, and precipitation in connection with the processing of these ores. A section on mill design considerations is also included. Results show the ores to be amenable to the Alkaline Leach–Filtration process. (auth)

6685

STUDIES ON THE EXTRACTION OF METAL COMPLEXES. XXVII. THE DISTRIBUTION OF SOME ACTINIDES AND FISSION PRODUCTS BETWEEN METHYL ISOBUTYL KETONE AND AQUEOUS SOLUTIONS OF HNO_3 AND $Ca(NO_3)_2$. Jan Rydberg and Brita Bernstrom (Research Inst. of National Defence, Sundbyberg, Sweden). Acta Chem. Scand. 11, No. 1, 86-97(1957).

The distribution ratios of U^{6+}, Pu^{6+}, Pu^{4+}, Th^{4+}, Zr^{4+}, La^{3+}, Ca^{2+}, Na^+ and HNO_3 between methyl isobutyl ketone and aqueous solutions of varying HNO_3 and $Ca(NO_3)_2$ concentrations have been determined and are given. Some possible methods of separating U and Pu from certain fission products are discussed. (auth)

6686

EQUILIBRIUM ULTRACENTRIFUGATIONS OF ACIDIC Hg(I), Hg(II), In(III), AND Au(III) SOLUTIONS. James S. Johnson and Kurt A. Kraus (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 79, 2034-6(1957) May 5.

Equilibrium ultracentrifugations confirm that In^{3+} in HBr and Au^{3+} in HCl exist as mononuclear complexes. The results contradict recent suggestions based on solvent extraction data that dimers of In^{3+} and Au^{3+} exist in the aqueous phase. The method was checked by comparing apparent molecular weights of Hg^{+} and Hg^{2+} in nitrate solutions. (auth)

6687

ION-EXCHANGE AND SOLVENT-EXTRACTION STUDIES WITH POLONIUM. J. Danon and A. A. L. Zamith. J. Phys. Chem. 61, 431-4(1957) Apr.

An investigation has been made of the ion-exchange and solvent-extraction behavior of polonium in hydrochloric and nitric acid media. Adsorption by an anion-exchange resin, Dowex-1, from nitric acid solutions is unusually slow. Reducing agents, which had no effect on anion exchange and solvent extraction in hydrochloric acid solutions, exerted a marked influence on these processes in nitric acid media. The tendency of polonium to form complexes and its oxidation-reduction reactions are discussed. (auth)

6688

VAPOR PRESSURE STUDIES INVOLVING SOLUTIONS IN LIGHT AND HEAVY WATERS. IV. SEPARATION FACTOR AND CROSSOVER TEMPERATURE FOR SALT SOLUTIONS OF THE MIXED WATERS AND FOR A MIXTURE OF THE PURE WATERS FROM 100° TO THE CRITICAL TEMPERATURE. Robert L. Combs and Hilton A. Smith (Univ. of Tennessee, Knoxville). J. Phys. Chem. 61, 441-7 (1957) Apr.

6689

EBULLITION FROM SOLID SURFACES IN THE ABSENCE OF A PRE-EXISTING GASEOUS PHASE. S. G. Bankoff. Trans. Am. Soc. Mech. Eng. 79, 735-40(1957) May.

The nucleation theory of Volmer and Fisher is extended to the superheating of liquids in contact with various solid boundaries. It is shown that nucleation in the bulk phase, at flat surfaces, at sharp projections, or in wetted cavities can be dismissed from consideration as possible explanations for experimentally observed superheats. Unwetted cavities are preferred nucleation points; but the difficulties of filling these completely with liquid are so great that it is probable that nucleation almost always occurs at a pre-existing gaseous phase in static stressing of the liquid. Nucleation in dynamic-stress phenomena, such as ebullition, cavitation, or effervescence, always occurs at the boundaries of gas or vapor entrapped in surface cavities. (auth)

6690

FLOTATION. A. M. Gaudin. New York, McGraw-Hill Book Company, Inc., 1957. 581p.

The application of flotation to the separation of finely divided solids, concentration of metallic ores, cleaning of solid fuels, beneficiation of nonmetallic minerals, separation of solids from liquids, and separation of nonmineral solids from each other are described. (W.L.H.)

Refer also to abstracts 6695 and 6890.

SPECTROSCOPY

6691 AD-113849

Library of Congress. Technical Information Div., Washington, D. C.

INFRARED. A REPORT BIBLIOGRAPHY. Oct. 1956. 22p. (ARC-302(Suppl. 1)).

6692

THE ADAPTATION OF A COMMERCIAL DOUBLE-BEAM INFRARED SPECTROPHOTOMETER FOR USE WITH A GRATING. H. C. Mattraw and F. P. Landis (Knolls Atomic Power Lab., Schenectady, N. Y.). Appl. Spectroscopy 2, No. 1, 31-8(1956) Nov.

A 60 line/mm Bausch and Lomb grating has been installed in a Baird Infrared Spectrophotometer in place of all prisms to cover the 2 to 26 micron range of the instrument. No changes were made in the optical system for the 2 to 10 micron region. To avoid overlapping of higher orders on the longer wave length first order spectrum, one small mirror was replaced by a crystal of MgO. An alternate method, referred to as negative filtering, is presented for the elimination of overlapping orders and may be used with the double-beam instruments. The existing scanning equipment was used with the following modifications: (1), a mechanical linkage was tied to the existing Littrow mirror drive to rotate the grating and (2), new cams were substituted for the prism cams to provide linear wave length scans with the grating. One cam covers 6 microns of any region of the spectrum before resetting the grating, while the second cam can be used to obtain four times the dispersion of the first cam. The method described is simple to install and has the flexibility to obtain spectra with up to ten times the dispersion of the NaCl or KBr prisms. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

6693

THE REDUCTION OF PLUTONIUM BY TETRAVALENT URANIUM. Jan Rydberg (Research Inst. of National Defence, Sundbyberg, Sweden). Acta Chem. Scand. 11, No. 1, 201-2(1957).

URANIUM AND URANIUM COMPOUNDS

6694 AERE-C/R-1217

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

U^{233} PRODUCTION. CONCENTRATION AND PURIFICATION OF THE PRODUCT FROM SOLVENT EXTRACTION BY THE ANION EXCHANGE RESIN DEACIDITE FF. I. L. Jenkins and R. J. Richardson. July 1953. 14p.

The absorption of U and Th from the product of the solvent extraction process for U^{233} has been examined. Satisfactory U uptake and separation from Th has been obtained. Elution of the loaded columns has given a good volume reduction in the case of U but the elution of Th has been unsatisfactory. The product from the ion exchange method has a Th content of less than 1% and it is concluded that the method is satisfactory. Further work on the elution of Th is needed. (auth)

6695 TID-3502

Technical Information Service Extension, AEC.

SOLVENT EXTRACTION OF URANIUM. A Literature Search. Richard J. Smith, comp. Mar. 1957. 22p. $0.25(OTS).

A list of 159 references to solvent, or liquid-liquid, extraction of U with emphasis on production processes is presented. (auth)

6696

AN INVESTIGATION OF CONDITIONS FOR PRECIPITATION OF URANIUM(IV) ORTHOPHOSPHATE. Erik Strandell (Royal Inst. of Tech., Stockholm, Sweden). Acta Chem. Scand. 11, No. 1, 105-19(1957).

The precipitation of U as uranium(IV) orthophosphate from low concentrated acid solutions depends greatly on

the possible presence of Al salts in the solutions. At high concentrations of Al^{3+}, no precipitation is obtained. In chloride solutions consisting of UCl_4, $AlCl_3$, H_3PO_4 and HCl, the precipitation is prevented due to the information of soluble double complexes between U, Al and PO_4 ions. In sulfate solutions consisting of $U(SO_4)_2$, $Al_2(SO_4)_3$ and H_2SO_4, the precipitate is formed only within a relatively narrow pH range around pH 1. At higher pH values, precipitation is prevented probably by the same double complexes as in chloride solutions. At lower pH values, precipitation is prevented mainly by soluble complexes between U and SO_4. (auth)

6697
COMPLEXES OF THE 4d- AND 5d-GROUPS. IV. ELECTRON TRANSFER BANDS WITH SPECIAL APPLICATION TO M. DELEPINE'S COMPLEXES AND A TRANSITION FROM IRIDIUM(III) TO PYRIDINE, WITH SOME REMARKS ABOUT INTERMEDIATE COUPLING IN HALIDE COMPLEXES AND THE URANYL ION. Chr. Klixbüll Jorgensen (Univ. of Denmark, Copenhagen). Acta Chem. Scand. 11, No. 1, 166-78(1957).

Refer also to abstracts 6659 and 6718.

WASTE DISPOSAL

6698 HW-47088
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THE DESIGN AND APPLICATION OF A HEAT TRANSFER ANALOGUE FOR RADIALLY SYMMETRICAL PROBLEMS. M. W. Cook. Jan. 30, 1957. 39p. Contract [W-31-109-Eng-52]. $7.80(ph OTS); $3.30(mf OTS).

An electrical heat transfer analogue of a typical HAPO waste tank has been designed, constructed, and tested. A typical steady state temperature profile obtained from this analogue is reported. A complete summary of both steady and transient state temperature profiles is presented and discussed in HW-47087. The analogue, which was constructed of Teledeltos conductive paper, is shown. Design and Construction details are discussed and this particular type of analogue is compared with other methods of solving the problem. The analogue comprises approximately 3000 individual resistance elements which were made by drafting techniques. Approximately 125 drafting hours were required, and about 400 man hours were required to design, assemble and test the analogue. Although the materials used in the analogue were very inexpensive, the large costs of man power would indicate that future analogues of this kind could be constructed more economically from standard carbon resistors. Such an analogue would also be more compact. With either type of conductor a satisfactory accuracy is obtainable. (auth)

6699 IGR-TN/D-443
Gt. Brit. Dounreay Works, Caithness, Scotland.
FACTORS AFFECTING THE DISTANCE OF THE DISCHARGE POINT FROM THE SHORE IN THE SEA DISPOSAL OF EFFLUENT. A. E. Shaw. Feb. 1957. 11p.

Refer also to abstract 6711.

ENGINEERING

6700 NP-6260 (Rpt:
Mine Safety Appliances Co., Callery, Penna.
PROGRESS REPORT NO. 39 FOR FEBRUARY AND MARCH, 1957. W. J. Posey, ed. Apr. 12, 1957. 31p. Contract NObs-65426.

(For preceding period see NP-6209.)

6701 WADC-TR-54-98(Pt. 2)
Connecticut Hard Rubber Co., New Haven.
INVESTIGATION AND DEVELOPMENT OF HIGH-TEMPERATURE STRUCTURAL ADHESIVES. Report No. 2 [for] June 1, 1954 to May 1, 1955. Kenneth L. McHugh. June 30, 1955. 96p. Project title: JET ROTORS. Task title: HEAT RESISTANT ADHESIVES. Contract AF33(616)-2448. (AD-73567).

An epoxy-modified silicone resin composition for use as a metal-to-metal adhesive was developed which displays shear strength values slightly in excess of the target requirement of 1000 psi at 500°F, and shear strength values at room temperature of about 1100 psi. The highest shear strength value obtained at 500°F in an evaluation of seventy-seven commercial silicone and organo-modified silicone resins was 560 psi. A commercial organo-modified silicone resin produced a much higher shear strength at room temperature (average, 2300 psi), but a low shear strength at 500°F (average, less than 100 psi). Experimental silicone resins were prepared which displayed shear strength values appreciably higher than those of the best commercial silicone resins. The best high-temperature shear strength values were found in resins having an R/Si ratio from 1.10 to 1.30 and a methyl content from 30 to 60%. Epoxy-modified silicone resins were the most promising of almost one hundred modifications prepared with epoxy, alkyd, phenolic, and polyamine resins. Silicone-isocyanate copolymers, while not yet practical, showed interesting results. The Karl Fischer reagent was found useful for the determination of silanol groups in silicone resins. Asbestine X and TiO_2 fillers reinforced the silicone and organo-modified silicone resins to some extent. Glass fabric was of little or no value as a reinforcement. (auth)

6702
THE DESIGN OF A VERY SLOW SPEED RELUCTANCE MOTOR FOR ATOMIC REACTOR ROD MECHANISM DRIVE. D. A. Guerdan (Westinghouse Electric Corp., Pittsburgh). Power Apparatus and Systems 26, 1015(1956).

HEAT TRANSFER AND FLUID FLOW

6703 AGC-1310-3
Aerojet-General Corp., Azusa, Calif.
EXPERIMENTAL STUDIES ON HEAT TRANSFER AND FLUID FLOW SYSTEMS. Quarterly Progress Report No. 3 [for] January 1 through March 31, 1957. M. E. Ellion, L. Green, Jr., and K. L. Nall. Apr. 30, 1957. 25p. Project 6-(1-9964). Contract AF33(616)-3767.

Fabrication of the test furnace for extended-surface heat-transfer studies is now completed, with the exception of the thermocouple to be employed in measuring high exit-gas temperatures, the furnace aft-closure, and the exhaust tube liners. The transparent-wall nozzle section for flow separation studies is now being fabricated. Fabrication of the spark shadowgraph and Schlieren systems is completed. A second, tentative model of the mechanism of heat transfer in the vicinity of the critical point has been formulated and is discussed. The instrumentation system which is required to control and measure the heat transferred to a flow of fluid near its critical point has been designed, and equipment is being procured. (auth)

6704 AGC-AE-23
Aerojet-General Corp., Azusa, Calif.
POLYPHENYL-COOLANT BURNOUT STUDIES. Monthly Progress Report [for] August 26 through September 25,

1956. Oct. 6, 1956. 8p. Contract AT(04-3)-44. (AGC-L2917-3). $1.80(ph OTS); $1.80(mf OTS).

Progress in fabrication and installation of equipment for heat transfer burnout studies of polyphenyls is continued. (T.R.H.)

6705 NDA-24

Nuclear Development Corp. of America, White Plains, N. Y.

BOILING BURNOUT PROGRESS. [Issue] No. 8. Unclassified Section. (15J-12). John E. Viscardi, ed. Feb. 23, 1956. 51p. Contract AT(30-1)-862. $9.30(ph OTS); $3.60(mf OTS).

There is no Classified Section of Issue No. 8.

The latest experimental results on boiling and related phenomena are reported and discussed. Burnout, maximum heat transfer rates, frequency and formation characteristics of bubbles and vapor films, influence of element shape and surface properties, role of impurities, dissolved gases and pH values, temperature and density distributions, pressure drops, instability, corrosion, cavitation, and metal-water reactions are among the topics treated. (auth)

6706 RDB(W)/TN-49

Gt. Brit. Windscale Works, Sellafield, Cumb., England.

TEMPERATURE DISTRIBUTION IN A "DOUBLE ANNULUS" HEAT EXCHANGER. W. B. Hall. Mar. 1953. 7p.

Studies of the temperature variations occurring in a double annulus counter-flow heat exchanger operating with liquid metals are reported. (T.R.H.)

6707

HEAT TRANSFER. LOUISVILLE. F. J. Van Antwerpen, ed. Chem. Eng. Progr. 52, Symposium Ser. No. 18, 1956. 116p.

A generalized correlation is presented that predicts the burnout conditions over a wide range of pressures, velocities, geometrical configurations, and heat-flux densities but is limited to the local boiling region for water. Heat transfer coefficients were determined for Hg vapor condensing on both water- and air-cooled vertical steel, copperplated steel, nickel, and stainless steel. The data and correlations for the rate of convective heat transfer for gases flowing across a cylinder was re-examined. Experimental results are reported for pressure drop during forced-circulation boiling of distilled water in an electrically heated horizontal tube. Circulation rates and overall temperature driving forces in a vertical thermosyphon reboiler were measured. Heat and mass transfer in cooler condensers of $TiCl_4-N_2$ system is presented. The effect of air rate, water rate, temperature, and packing density in a cross flow cooling tower are described. A study of heat transfer to organic liquids in single-tube, natural-circulation, vertical-tube boilers is presented. The effect of agitation on the critical temperature difference for a boiling liquid is described. Heat transfer and fluid friction in a shell- and -tube exchanger with a single baffle are described. Measurement and prediction of density transients in a volume-heated boiling system are presented. (W.L.H.)

6708

MEASUREMENT OF LOCAL HEAT TRANSFER COEFFICIENTS WITH SODIUM–POTASSIUM EUTECTIC IN TURBULENT FLOW. K. D. Kuczen and T. R. Bump (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, 181-98(1957) Apr.

Local heat transfer coefficients were measured in a circular, copper tube of inner diameter 0.25 in., outer diameter 0.55 in., and length 36 in. Direct resistance heating of the tube wall from a direct current power source dictated the size and material of the test section. Since the electrical resistivity of copper varies appreciably with temperature, the radial heat flux was nonuniform along the length. (The temperature drop across the tube wall was small; therefore the heat flux in the radial direction was assumed uniform.) The test section was cooled from the inside with the eutectic alloy of sodium and potassium (22% Na, 78% K) flowing turbulently in a vertical direction. The range of variables covered in the experiment was as follows: fluid temperature from 85° to 1175°F, fluid velocity 4 to 60 ft/sec, Reynolds number 13,000 to 466,000, Peclet number 268 to 3850, average heat flux 28,600 to 3,200,000 Btu/(hr ft^2). The maximum local heat flux was 6,000,000 Btu/(hr ft^2). For the above test conditions the experimentally measured Nusselt numbers ranged from 1.4 at the low Peclet number to 22.4 at the high Peclet number. Most of the fully-developed Nusselt numbers found are lower than indicated by the Lyon-Martinelli equation, but are in quite good agreement with data of most other experimenters. The values of Nusselt number in the entrance region are about 40% higher than those predicted by Deissler, and approximately 10% higher than the data of Johnson, Hartnett, and Clabaugh. Near a Peclet number of 300, the Nusselt numbers observed were lower, by a factor of more than two, than the theoretical minimum for fully developed laminar flow. The reason for this abnormality has not been established. (auth)

6709

HEAT TRANSFER RATES TO CROSSFLOWING MERCURY IN A STAGGERED TUBE BANK. I. R. J. Hoe and O. E. Dwyer (Brookhaven National Lab., Upton, N. Y.) and D. Dropkin (Cornell Univ., Ithaca, N. Y.). Trans. Am. Soc. Mech. Eng. 79, 899-907(1957) May.

An experimental heat-transfer program has been under way for some time at the Brookhaven National Laboratory, the general purpose of which is to obtain and correlate heat-transfer coefficients for liquid metals flowing outside of tube banks. This paper covers one phase of the program; i.e., the measurement of heat-transfer coefficients for mercury flowing normal to a staggered tube bank. The factors studied were linear velocity, tube location in the bank, circumferential variation of the local coefficient for a single tube, type of contact, i.e., wetting versus nonwetting, and pressure drop. (auth)

MATERIALS TESTING

6710 NP-6263

Shell Development Co., Emeryville, Calif.

ENGINE OIL DEVELOPMENT. Quarterly Progress Report No. 5 [for] November 1, 1956 through January 31, 1957. C. L. Mahoney, W. W. Kerlin, E. R. Barnum, and K. J. Sax. 40p. Contract AF33(616)-3182. (S-13715).

Aromatic containing materials were investigated further for use as high temperature radiation resistant lubricants. To date, most promising results have been obtained with various polyphenyl ether derivatives. The unsubstituted ethers, such as bis(p-phenoxyphenyl) ether, are highly stable thermally and can be used under oxidizing conditions at temperatures of 500°F or higher. They are solids at ambient temperatures, however. By careful selection and positioning of substituents, low melting compounds suitable for use under oxidizing conditions at temperatures of 450 to 500°F can be prepared. The most stable substituted ethers found so far contain tert-butyl- or α-cumyl-groups. Radiation resistance is generally high with polyphenyl ether derivatives even in the presence of O. Deposit forming tendencies at high temperatures are low both before and after irradiation to 10^8 rad. Preliminary high-temperature Four-Ball data indicate superior lubri-

cating characteristics as compared to most other types of stable aromatic materials. For example, at 400°F and loads to 40 kg, various polyphenyl ether derivatives had wear scars comparable to or better than di-2-ethylhexyl sebacate or a petroleum white oil. In contrast, such aromatic materials as a methyl phenyl silicone, triphenylmethylsilane and m-terphenyl formed very large scars under the same condition. Larger amounts of several polyphenyl ether derivatives are being prepared to obtain additional information on lubrication properties. Additional synthetic work is also underway to develop materials with maximum stability and performance characteristics having the best possible physical properties. (auth)

Refer also to abstract 6958.

PUMPS

Refer to abstract 6958.

WASTE DISPOSAL

6711

THE CONTROL, CONVEYANCE, TREATMENT AND DISPOSAL OF RADIOACTIVE EFFLUENTS FROM THE ATOMIC WEAPONS RESEARCH ESTABLISHMENT, ALDERMASTON. W. L. Wilson, P. A. F. White, and J. G. Milton. J. Brit. Nuclear Energy Conf. 1, 149-72(1956) July.

The paper states that the principles adopted were developed from those originally devised for and used at the Atomic Energy Research Establishment, Harwell, and shows how attempts were made to overcome certain limitations that became evident there in the construction and early operational phases. It sketches these limitations and describes the solutions adopted. The paper mentions the prospective use of special decontaminants and the measures taken to deal with them. A description is given of the research that was undertaken to determine the form of the effluent-treatment and distillation plant and shows the approach which led to the type of plant and its required performance. The types and costs of chemical additives examined and the final results achieved are stated. The full-scale plant is described in detail together with particular additional developments, primarily those dealing with the safe 'canning' of active sludges. The investigation into disposal points for liquid wastes is outlined and is followed by a description of the storage facilities and discharge pipelines. Attention is drawn to the steps taken to convey the effluent safely. A description of the works at and in the River Thames is given together with an outline of the special trials showing how diffusion therein was achieved. (auth)

6712

HOW RADIOACTIVE WASTES WILL BE HANDLED AT PWR. J. R. LaPointe (Westinghouse Electric Corp., Pittsburgh). Nucleonics 15, No. 5, 114-16(1957) May.

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

6713 TID-7530(Pt. 1)

Oak Ridge National Lab., Tenn.

CERAMIC INFORMATION MEETING HELD AT OAK RIDGE NATIONAL LABORATORY ON OCTOBER 1, 2, AND 3, 1956. Apr. 1957. 165p. $1.00(OTS).

Thermodynamic calculations for the behavior of fission products in a high-temperature carbide pile are presented. A survey on the thermodynamic stability of a number of refractory oxides is presented. Methods for determination of melting points of UO_2 and other refractories are presented. The characteristics of sinterable BeO powders was determined quantitatively. The radiation stability of some ceramic materials is described. The oxidation of SiC in air at temperatures up to 2300°C is discussed. An experimental technique for fabricating high density fuel elements by high temperature (> 2000°C) flame techniques is described. A study to find means of producing a dense ThO_2 body with good thermal shock resistance and adequate mechanical strength is presented. Preliminary irradiation studies on ThO_2-UO_2 fuel bodies are presented. (W.L.H.)

6714 TT-650

MEASUREMENTS OF THE ELECTROMOTIVE FORCES (E.M.F.) IN THE SYSTEMS $FeO-Al_2O_3$ AND $MgO-Al_2O_3$ AND THE DIFFUSION OF FeO IN Al_2O_3 AT 1500°C. (EMF-Messungen in den Systemen $FeO-Al_2O_3$ und $MgO-Al_2O_3$ sowie Beobachtungen über die Diffusion von FeO in Al_2O_3 bei 1500°C.) W. A. Fischer. Translated by H. A. G. Nathan from Silicates ind. 20, 244-54(1955). 29p.

Potential measurements on the cells $Pt/Al_2O_3/Al_2O_3$ + FeO/Pt and $Pt/Al_2O_3/Al_2O_3$ + MgO/Pt at 1500°C are described. From the maximum emf values in the system $FeO-Al_2O_3$ a curve is obtained which is a function of the FeO concentration and which ascends steeply to 120 mv up to 1.5% FeO, but increases only to 175 mv in the concentration range of from 1.5 to 48.8% FeO and ascends discontinuously to 270 mv between 48.8 and 50% FeO, maintaining this value to 63% FeO. In the system $MgO-Al_2O_3$ the maximum potential increases from 66 to approximately 270 mv in the range of from 19.5 to 28.3% MgO and maintains this value of 270 mv in the range of from 28.3 to 100% MgO. High-temperature x-ray photographs in the system $FeO-Al_2O_3$ showed that the spinel $FeO \cdot Al_2O_3$ is the only compound formed by Al_2O_3 and FeO in the concentration range of from 0 to 63% FeO. This spinel remains stable up to 1500°C. From measurements of the diffusion of Fe from the spinel $FeO \cdot Al_2O_3$ into pure Al_2O_3 a diffusion content of $D = 4 \times 10^{-7}$ cm^2/sec^{-1} was obtained at 1500°C. The solubility of FeO in Al_2O_3 is approximately 1.5% at the given experimental temperature. A corrected phase diagram was prepared for the system $FeO-Al_2O_3$. The measurements show that there is ionic conduction at 1500°C in the systems $FeO-Al_2O_3$ and $MgO-Al_2O_3$. The shape of the potential curve as a function of the FeO concentration or MgO concentration, as the case may be, is explained qualitatively in terms of the phases present and the chemical potential of their components. (auth)

6715

IMMISCIBILITY AREA IN THE SYSTEM $TiO_2-ZrO_2-SiO_2$. G. Don McTaggart and A. I. Andrews (Univ. of Illinois, Urbana). J. Am. Ceram. Soc. 40, 167-70(1957) May.

A furnace for use in conjunction with the x-ray spectrometer was developed which was capable of heating small powdered specimens in air to temperatures as high as 1850° C. This furnace was also used for the heating and quenching of specimens in air from temperatures as high as 1850°C. An area of two liquids coexisting between 20 and 93 weight % TiO_2 above 1765° ± 10°C. was found to exist in the system TiO_2-SiO_2, which is in substantial agreement with the previous work of other investigators. The area of immiscibility in the system TiO_2-SiO_2 was found to extend well into the system $TiO_2-ZrO_2-SiO_2$. The two liquids were found to coexist over a major portion of

the TiO_2 (rutile) primary-phase area with TiO_2 (rutile) being the primary crystal beneath both liquids. The temperature of two-liquid formation in the ternary was found to fall about 80°C. with the first additions of ZrO_2 up to 3%. With larger amounts of ZrO_2 the change in the temperature of the boundary of the two-liquid area was so slight as to be within the limits of error of the temperature measurement. Primary-phase fields for TiO_2 (rutile), tetragonal ZrO_2, and $ZrTiO_4$ were found to exist in the system $TiO_2-ZrO_2-SiO_2$. SiO_2 as high cristobalite is known to exist in the system $TiO_2-ZrO_2-SiO_2$. (auth)

6716

ON THE PREPARATION OF CERMETS WITH CrB, TiB_2, AND WB. I. I. Iskol'dskiĭ and L. P. Bogorodskaya. Zhur. Priklad. Khim. 30, 177-85(1957) Feb. (In Russian)

Experiments to produce cermets with CrB, TiB_2, and WB cemented by Co, Ni, or Fe showed negative results; the attempts to prove that CrB and TiB_2 chemically combine and form solid solutions with W carbides and W borides, also, were unsuccessful. However, it has been revealed that Fe, Ni, Co, and W combine with the borides of metals and form a new triple boron-metal system. The system CrB-Fe, CrB-Ni, CrB-Co, CrB-W and the TiB_2-Fe, TiB_2-Ni, TiB_2-Co, and TiB_2-W were studied and new phases observed. (R.V.J.)

CORROSION

6717 ANL-5658

Argonne National Lab., Lemont, Ill.

EXPERIMENTS IN CORROSION MECHANISM: ALUMINUM AT HIGH TEMPERATURES. J. E. Draley and W. E. Ruther. Apr. 1957. 27p. Contract W-31-109-eng-38. $0.25(OTS).

Hydrogen analyses of corroded 1100 aluminum alloy have indicated an increase in hydrogen content of the metal near the corroding surface. Analyses of M-388 aluminum high temperature alloy have not indicated any such increase. The resistance to disintegrating attack in high temperature water is shown to improve with the amount and dispersion of the cathodic second phase present in the aluminum alloys. The relative abilities of various second phases to protect the alloy against disintegration are in the same order as their abilities to act as effective cathodes at the temperature of testing. Attempts to reduce the corrosion rate of resistant alloys by alloying the aluminum matrix with a solid solution additive have been largely unsuccessful. One alloy, Al-1% Ni-0.1% Ti, gave a lower equilibrium rate but a higher initial intercept. Phosphoric acid at pH 3.5 produces a sizable reduction in the equilibrium corrosion rate of M-388 alloy at 290°C. Tests in superheated steam indicate that cathodic second phases provide corrosion resistance in this medium as they do in water. A special aluminum alloy is shown to possess superior corrosion resistance when compared with Zircaloy-2 at 400°C-4000 psig. (auth)

6718 ANL-5672

Argonne National Lab., Lemont, Ill.

AQUEOUS CORROSION OF URANIUM AND URANIUM-6 w/o ZIRCONIUM ALLOY. Work performed: 1953-54. W. E. Ruther and W. B. Seefeldt. Jan. 9, 1957. 15p. Contract W-31-109-eng-38. $0.20(OTS).

The corrosion rates of U subjected to heat treatments of 600°, 720°, 800° and 1000°C asymptotically approached the lower corrosion rate of high purity U. Experiments in which hydrogen was deliberately added to heat-treated samples showed no correlation between corrosion rate and the hydrogen content. At a flow velocity of about 20 ft/sec of distilled water, U-Zr alloy corroded at low, but increasing, rates at 60° and 90°C. The water was saturated with a N_2-4.7 mol % O_2 mixture. The protective oxide film formed on initial immersion became less adherent and lost its interference colors after 30 days at 90°C. At 60°C this change of protective film occurred only at edges and corners. The increasing corrosion rate with time made it impossible to assign any single value for a corrosion rate. Little or no effect of the water flow rate was indicated by comparison of results with the previously reported behavior in static water. (auth)

6719 IGR-TN/W-454

Gt. Brit. Windscale Works, Sellafield, Cumb., England.

MASS TRANSFER IN LIQUID METAL CIRCUITS. A REVIEW OF PROGRESS IN INITIAL STUDIES. A. Draycott and P. D. Rich. Jan. 1957. 12p. (IGC-FRDC/P-217; IGC-SGDC/P-8).

Significant mass transfer of stainless steel constituents, and to a lesser extent of Zr has been measured in NaK circuits. In the first instance, at least, the oxide content of the liquid metal was a contributory influence. Solubility-temperature dependence was only one of several mechanisms that appeared to be operative, and isothermal mass transfer has been measured with some of the materials. In the circuits examined so far, washing with selected solvents has been a successful method of removing deposited activity. Methods of oxide determination are being surveyed; the Wurtz reaction has been usefully employed and promises wider scope with appropriate precautions. The next stage of the work being undertaken is detailed. (auth)

6720 ORNL-2284

Oak Ridge National Lab., Tenn.

THE EFFECT OF IRRADIATION ON THE CORROSION OF TYPE 347 STAINLESS STEEL BY URANYL SULFATE SOLUTIONS. F. H. Sweeton, M. D. Silverman, and H. O. Day. May 9, 1957. 31p. Contract W-7405-eng-26. $0.30(OTS).

Techniques were adapted for determining the corrosion of a metal exposed to a fissioning uranyl sulfate solution. A method based on the consumption of O_2 by the metal was found to be extremely useful for following corrosion both in and out of reactor radiation. A comparison with two other independent methods shows the technique to be reliable. Instrumental reproducibility of the order of 0.0014 mil was shown for an O_2 measurement, and the over-all results for similar corrosion tests have differed by no more than a factor of 2. From these exploratory experiments, it appears that reactor radiation above a power-density level of 4 w/ml causes a sharp rise in the corrosion rate. Radiation effects are not observed until after an initial induction period, which appears to depend on the amount of previous nonradiation exposure. The effect of temperature is apparently minor in the range 250 to 290°C. The pertechnetate ion at a concentration of 0.0005 m is apparently not an effective corrosion inhibitor in this system. It is recommended that these studies be continued to improve the experimental method and to obtain a better understanding of the variables affecting corrosion in these systems. (auth)

6721 WAPD-LSR(C)-134

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

REVIEW OF CARBON STEEL CORROSION DATA IN HIGH-TEMPERATURE, HIGH-PURITY WATER IN DYNAMIC SYSTEMS. Donald E. Tackett, Paul E. Brown, and Richard T. Esper. Oct. 14, 1955. 203p. $1.00(OTS).

Corrosion test results for carbon steel under conditions similar to those encountered in reactor operation are summarized. (T.R.H.)

6722
CORROSION STUDIES IN HIGH TEMPERATURE WATER BY A HYDROGEN EFFUSION METHOD. M. C. Bloom, M. Krulfeld, W. A. Fraser, and P. N. Vlannes (Naval Research Lab., Washington). Corrosion 13, 297t-302t(1957) May.

A new method for the measurement of static corrosion rates in aqueous systems at elevated temperature and pressure is briefly described. Data obtained by application of the method to ferrous systems are presented. These data include: the corrosion rate of low carbon steel in distilled water at 600°F, the effect of raising the Ph in such systems, the effect of thermal shock and of temperature rise on the corrosion rate, and the effect of heat treatment of the metal on the corrosion rate. Comparison is made between the corrosion rates of low carbon steel and stainless steel and some data are included on the effect of the wall thickness of low carbon steel specimens on the rate of H effusion resulting from corrosion at 600°F. (auth)

GEOLOGY AND MINERALOGY

6723
PROPOSED NOMENCLATURE OF PART OF UPPER TRIASSIC STRATA IN SOUTHEASTERN UTAH. John H. Stewart. Bull. Am. Assoc. Petroleum Geol. 41, 441-65 (1957) Mar.

The Triassic rocks in southeastern Utah have been divided into the Moenkopi formation of Early and Middle (?) Triassic age, and the Shinarump conglomerate, Chinle formation, and Wingate sandstone of Late Triassic age. Recent work has shown that the strata formerly called Shinarump conglomerate in southeastern Utah consist, in places, of a lower sandstone and conglomerate unit, a middle claystone and clayey sandstone unit, and an upper sandstone and conglomerate unit. The lower and upper units are Shinarump-type deposits whereas the middle unit is a Chinle-type deposit. Deposits of Shinarump-type and Chinle-type are interstratified and intertonguing. The writer proposes that the two types be grouped together in the Chinle formation and that the Shinarump conglomerate be redefined as the Shinarump member of the Chinle formation. The lower unit is correlative with strata in southwestern Utah, that are designated as type Shinarump conglomerate, and the writer proposes that the term Shinarump member be restricted in southeastern Utah to this lower unit. The middle and upper units, although formerly included in the Shinarump conglomerate, are considered as separate members of the Chinle formation. The middle unit has been defined as the Monitor Butte member of the Chinle formation, and the name Moss Back member is here proposed for the upper unit. In southeastern Utah, the Shinarump conglomerate included, in places, all of the Shinarump, Monitor Butte, and Moss Back members of the Chinle formation. In other places, the Shinarump conglomerate consisted only of the Moss Back member, and in still other parts of southeastern Utah the Shinarump conglomerate consisted of only the Shinarump member. Locally in the San Rafael Swell area, Emery County, a thin unit now called Temple Mountain member was included by previous workers in the Shinarump conglomerate. In addition to subdividing the strata previously included in the Shinarump conglomerate, the overlying part of the Chinle formation has been subdivided into members. As now recognized, the Chinle formation consists of seven members in southeastern Utah. They are, in ascending order, the Temple Mountain, Shinarump, Monitor Butte, Moss Back, Petrified Forest, Owl Rock, and Church Rock members. (auth)

6724
PRELIMINARY GEOLOGIC MAP OF THE BOOT MESA NW QUADRANGLE, ARIZONA-UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 84. Irving J. Witkind. Washington, U. S. Geological Survey, 1957. $0.50.

6725
PRELIMINARY GEOLOGIC MAP OF THE BOOT MESA NE QUADRANGLE, ARIZONA-UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 85. Irving J. Witkind. Washington, U. S. Geological Survey, 1957. $0.50.

6726
PRELIMINARY GEOLOGIC MAP OF THE BOOT MESA SE QUADRANGLE, ARIZONA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 86. Irving J. Witkind. Washington, U. S. Geological Survey, 1957. $0.50.

6727
PRELIMINARY GEOLOGIC MAP OF THE BOOT MESA SW QUADRANGLE, ARIZONA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 87. Irving J. Witkind. Washington, U. S. Geological Survey, 1957. $0.50.

6728
PRELIMINARY GEOLOGIC MAP OF THE AGATHLA PEAK NW QUADRANGLE, ARIZONA-UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 88. Irving J. Witkind. Washington, U. S. Geological Survey, 1957. $0.50.

6729
PRELIMINARY GEOLOGIC MAP OF THE AGATHLA PEAK NE QUADRANGLE, ARIZONA-UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 89. Irving J. Witkind. Washington, U. S. Geological Survey, 1957. $0.50.

6730
PRELIMINARY GEOLOGIC MAP OF THE AGATHLA PEAK SE QUADRANGLE, ARIZONA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 90. Irving J. Witkind. Washington, U. S. Geological Survey, 1957. $0.50.

6731
PHOTOGEOLOGIC MAP OF THE LEES FERRY NE QUADRANGLE COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-222. Kathleen McQueen. Washington, U. S. Geological Survey, 1957. $0.50.

6732
PRELIMINARY GEOLOGIC MAP OF THE AGATHLA PEAK SW QUADRANGLE, ARIZONA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 91. Irving J. Witkind. Washington, U. S. Geological Survey, 1957. $0.50.

METALS AND METALLURGY

6733 AECU-3456
Sandia Corp., Albuquerque, N. Mex.
EFFECT OF LOW TEMPERATURES ON TIN SOLDERS AND SOLDERED JOINTS. TIN CASTINGS, AND DIPPED TIN COATINGS. H. E. Montgomery. Jan. 25, 1957. 15p. Contract [AT-(29-1)-789]. (TM-273-56-16). $3.30(ph OTS); $2.40(mf OTS).

Surveys were made of the available scientific literature concerning low-temperature properties of Sn alloys and low-temperature allotropic change from white tetragonal structure to gray-cubic structure in Sn and Sn alloys. Work to date indicates that the probability of such change in commercial Sn–Pb solders is very remote, but that the probability of change in purer forms of solder is considerably greater. Certain additives, as Sb and Bi, inhibit change; others, as Ge, accelerate change. Procedures are recommended to minimize the probability of white-to-gray transformation in solder. (auth)

6734 ANL-5329
Argonne National Lab., Lemont, Ill.
EFFECT OF ROLLING TEMPERATURE ON THE PREFERRED ORIENTATION IN ROLLED URANIUM RODS. Final Report — Metallurgy Program 4.1.9. M. H. Mueller and H. W. Knott. Mar. 1957. 32p. Contract W-31-109-eng-38. $0.25(OTS).

A study was made of the radial symmetry of the texture produced by oval and hand round roll passes. Also studied was the orientation resulting in U rods rolled at 300, 400, 500, 600, and 640°C. (T.R.H.)

6735 ARL/MET-13
Australia. Aeronautical Research Labs., [Fishermen's Bend], Victoria.
THE CHROMIUM-RICH ALLOYS OF THE CHROMIUM–TITANIUM–TUNGSTEN SYSTEM AT 900° AND 1200°C. N. Ryan. July 1955. 15p.

Metallographic and x-ray determinations of the phase boundaries in the Cr–Ti–W system at the 900 and 1200°C isothermals revealed that the α Cr solid solution was bounded by only two two-phase regions (α Cr. S.S. + α Cr. S.S. + $TiCr_2$). These regions bordered a three phase region (α Cr + α W + $TiCr_2$) considered to result from a eutectoid reaction between the three phases. The solid solubility of W and $TiCr_2$ in Cr showed an appreciable increase as the temperature was raised from 900 to 1200°C, which affect appeared to diminish as the corner of the three phase field was approached. (auth)

6736 BM-IC-7771
Bureau of Mines.
BIBLIOGRAPHY OF ZIRCONIUM. Eleanor Abshire. June 1955. 284p.

This bibliography is the result of a cooperative project undertaken by the Bureau of Ships and the Bureau of Mines to accumulate literature published to date on Zr and Hf and to establish an information center on these metals for the use of any interested research organization or library. The bibliography, which will be supplemented as additional information is accumulated, consists of references, with abstracts, to pertinent literature on the subject published from 1907 to date. (auth)

6737 KAPL-M-AME-5
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G SEAL WELD — UNIT CELL TO STANDPILE HOUSING. Robert L. Harris. Feb. 7, 1957. 10p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The consumable insert type omega seal weld has many advantages over other types of seal welds. Among these advantages are slag-free welds, complete weld penetration, reinforcement of the weld bead, no need for addition of filler metal and its attendant problems in a confined area, the ability to determine approximate weld penetration by the shape and size of the weld bead, and the ability to repair with ease sections which for any reason have not been fused. Tests indicate that the omega seal with consumable insert type weld meets all design specifications. (auth)

6738 NACA-TN-4000
Langley Aeronautical Lab., Langley Field, Va.
A PHENOMENOLOGICAL RELATION BETWEEN STRESS, STRAIN RATE, AND TEMPERATURE FOR METALS AT ELEVATED TEMPERATURES. Elbridge Z. Stowell. Feb. 18, 1957. 19p.

A phenomenological relation between stress, strain rate, and temperature is suggested to account for the behavior of polycrystalline metals above the equicohesive temperature. The properties of the metal included in the relation are elasticity, linear thermal expansion, and viscosity. The relation may be integrated under various conditions to provide information on creep rates, creep rupture, stress-strain curves, and rapid-heating curves. It is shown that for one material–7075-T6 Al alloy sheet–the information yielded by the relation for these four applications agrees reasonably well with test data. (auth)

6739 NP-6284
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
SELECTED PHOTOMICROGRAPHS OF TITANIUM AND TITANIUM ALLOYS. H. R. Ogden. Mar. 29, 1957. 10p.

6740 NP-6293
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
TITANIUM ALLOYS FOR THERMAL FLIGHT. R. I. Jaffee. Apr. 17, 1957. 14p.

The elevated temperature tensile strengths for various classes of titanium alloys are graphed and discussed. Present applications and future needs for titanium are mentioned. Graphs on ultimate strength and creep strength vs. temperature, effect of surface contamination on tensile ductility, and the effect of heat treatment on the elevated temperature tensile strength of various alloys are included. (M.H.R.)

6741 NYO-4869
New York Operations Office. Health and Safety Lab., AEC.
HEALTH AND SAFETY IN POWDER METAL HANDLING. W. B. Harris. Apr. 1957. 23p. $0.20(OTS).

The use of metal powders of interest to the AEC is discussed. Those properties of powders which present unusual problems of health and safety are presented together with the possible effects which these powders may have on workers and their environment. Protective measures and equipment for controlling fire, explosion, and health hazards are presented. (auth)

6742 WADC-TR-56-453
Massachusetts Inst. of Tech., Cambridge.
FACTORS AFFECTING THE FLUIDITY AND HOT CRACKING OF MAGNESIUM ALLOYS. Period Covered: June 1955 to June 1956. Howard F. Taylor and Merton C. F. Flemings, Jr. Oct. 1, 1956. 92p. Project title: METALLIC MATERIALS. Task title: ALUMINUM ALLOYS and IMPROVED MAGNESIUM ALLOYS. Contract AF-33(616)-2958. (AD-118011).

A vacuum fluidity apparatus was used to determine the fluidities of magnesium alloys. The alloy systems studied were: Mg-Al binary system from 0 to 20% Al; Mg-Zn binary system from 0 to 20% Zn; Mg-Al-Zn ternary system up to 20% alloy content; Mg-Zn-Zr system from 0 to 20% Zn; Mg-Th-Zr system from 0 to 20% Th. Fluidity was determined as a function of temperature for each alloy. Then fluidity at 1400°F was plotted as a function of alloy content. Fluidity at 100°F superheat was plotted for those alloy systems for which the liquidus temperature had been established. Comparison of commercial alloys with the experimental alloys was good. Fluidity curves as a function of alloy content were found to vary as the inverse of computed, non-equilibrium freezing range curves. A hot tear pattern was adapted for studying the effect of geometry on the hot tearing of Mg alloys, and for determining the susceptibility of various Mg alloys to hot tearing; the pattern is stressed in simple tension during solidification. The portion of the test casting susceptible to hot tearing is well fed. Hot tearing in Mg–4% Al alloys was shown to increase with decreasing fillet radius, increasing casting length, increasing section size change, and decreasing gas content. An experimental apparatus was developed for the measurement of alloy rupture stress and ductility at temperatures above and below the solidus. The apparatus

permits stress rupture measurements without first cooling the cast alloy to room temperature. (auth)

6743 WADC-TR-56-597

Battelle Memorial Inst., Columbus, Ohio.

STUDIES OF FACTORS AFFECTING THERMAL STABILITY OF TITANIUM-BASE ALLOYS. Period Covered: October 1955 to October 1956. Frank C. Holden, Horace R. Ogden, and Robert I. Jaffee. Dec. 19, 1956. 62p. Project title: METALLIC MATERIALS. Task title: TITANIUM METALS AND ALLOYS. Contract AF-33(616)-3208. (AD-110748).

Studies were made to determine the factors that influence the stabilization and the thermal stability of alpha-beta Ti alloys. Thermal stability for three commercial alloys, MST-6Al-4V, Ti-155A, and C-130AM, was good for three heat-treatment conditions under creep exposure tests through 800°F. Some loss of ductility was observed for the Ti-155A and C-130AM alloys fabricated in the beta field and annealed in the alpha–beta field. Substitutions of various beta stabilizers in a Ti–5Cr–5Mo alloy were made to check their effects on thermal stability. The active eutectoid formers, Ni, Cu, and Cr, were detrimental; thermal stability was improved by substitutions of Mn or Mo, and by Al additions. Small amounts of strain, introduced either before equilibration or before stabilization, had no significant effect on thermal stability of a Ti–5Cr–5Mo alloy. (auth)

6744

ON THE ENTROPY OF SOLID AND LIQUID METALS. G. Borelius (Royal Inst. of Tech., Stockholm). Arkiv Fysik 11, No. 5, 421-7(1957).

A theoretically natural division of the observed heat capacity C_p values into a kinetic and potential part has been made. The connections between the potential part of the entropy and the changes of volume are discussed from this point of view. The available data for pressures of the order one atmosphere restricts discussion to the case of constant, practically zero, pressure. Results are graphed and tabulated. (M.H.R.)

6745

DIFFUSION OF NICKEL IN NICKEL OXIDE. Moon Taik Shim and Walter J. Moore (Indiana Univ., Bloomington). J. Chem. Phys. 26, 802-4(1957) Apr.

Diffusion coefficients for Ni in polycrystalline and monocrystalline NiO have been measured by the surface-activity method from 1000 to 1400°C in air. Within experimental uncertainty the values $D = 4.4 \times 10^{-4} \exp(-44.2/RT)$ fit both cases. These results indicate that the oxidation of nickel under comparable conditions of T and P proceeds via lattice diffusion of Ni through NiO. (auth)

Refer also to abstract 6770.

PHYSICS

6746 AERE-T/R-1601

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

ON THE SUCCESSIVE REFLECTED SHOCK WAVES CAUSED BY A PISTON MOVING WITH UNIFORM VELOCITY INTO A CLOSED CYLINDER WITH AND WITHOUT A SUPERPOSED MAGNETIC FIELD. R. T. P. Whipple. Jan. 1955. Decl. Feb. 13, 1957. 32p.

In order to investigate the effect of magnetic fields on shock waves in conducting gases a very simple example has been considered. It is supposed that a piston suddenly starts to move with uniform velocity into a cylinder of finite length, setting up a plane shock wave which is reflected successively at the far end of the cylinder and the piston. It is shown that as the compression increases the temperature ultimately rises adiabatically, i.e. like $\rho^{\gamma-1}$. Starting from "cold," for a given piston velocity and compression, the ratio of the temperatures attained with a large initial magnetic field and with no field does not exceed 1.289 if $\gamma = 1.4$. Thus magnetic fields do not seem to be very useful in raising the temperature behind plane shock waves. (auth)

6747 CF-57-4-77

Oak Ridge National Lab., Tenn.

THE CHOICE IN THORIUM OXIDE SLURRIES FOR THE PREVENTION OF CAKING IN CIRCULATING SYSTEMS. R. N. Lyon. Apr. 22, 1957. 13p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A qualitative theory for cake formation in ThO_2 slurries is presented. The sphere formation which occurs in "Standard" slurry can be explained on the same basis. The irregular and unpredictable yield strength is easily fitted into the theory. On the basis of this theory, the writer has been led to the conclusion that only colloidally stable slurries, or slurries with crystallites or comminution-resistant particles which are large enough to overcome colloidal effects (probably larger than 0.1μ) can be used with assurance in a ThO_2 reactor system. This conclusion holds for 300 g/kg slurries as well as for more concentrated mixtures. (auth)

6748 NP-4859(Suppl. 9)

Little (Arthur D.) Inc., Cambridge, Mass.

LOW TEMPERATURE BIBLIOGRAPHY FOR THE FIELD OF CRYOGENICS. Supplement No. 9. Mar. 1957. 9p.

A compilation of reports issued after 1944 on low-temperature physics, including theoretical and experimental research at temperatures of 20°K and below, together with techniques and equipment applicable to the field of cryogenics is presented. (J.E.D.)

6749 NP-6257

Naval Research Lab., Washington, D. C.

DEVICES FOR DAMPING MECHANICAL VIBRATIONS. Bibliography No. 10, Part 1. Mildred Benton, comp. Dec. 1956. 101p.

This bibliography, covering the period 1924–August 1956, includes references to periodical articles and technical report literature which offer information on damping devices within the field of reference outlined above. They were selected by means of a systematic search of the following sources. (auth)

6750 AEC-tr-2899

FERROELECTRICS. Herbert Sachse. Excerpts translated from Ferroelektrika; Technische Physik in Einzeldarstellungen. Bd. XI. Springer-Verlag (Berlin). 1955. 99p.

The ferroelectric properties of titanates, zirconates, stannates, niobates, and tantalates are treated. General theory, pressure dependence, field dependence, and applications are discussed. (T.R.H.)

6751 AEC-tr-2912

EQUILIBRIA BETWEEN WATER AND SODIUM AND POTASSIUM NITRATES AND SULFATES. E. Cornec, H. Krombach, and A. Spack. Translated by K. S. Bevis from Compt. rend. 188, 1250-3(1929). 3p.

6752 AEC-tr-2913

MEASUREMENT OF PARTIAL VAPOR PRESSURES OF HNO_3–H_2O MIXTURES AT 20°C AND VERIFICATION OF THE MARGULES-DUHEM EQUATION. M. R. Vandoni and M. Laudy. Translated by K. S. Bevis from J. chim. phys. 49, 99-102(1952). 8p.

This study which follows a series of tests made at 0° is directed toward the exact determination of low water vapor pressures (of the order of a millimeter or less). It entails serious procedure for setting up curves for reciprocal vapor–liquid compositions. Some of the equipment used was new. The method employed was a combination of the dynamic and static processes. (auth)

6753 AEC-tr-2914

PART II–VERIFICATION OF THE MARGULES-DUHEM EQUATION FOR HNO_3–H_2O MIXTURES AT 20°C. G. Aunis. Translated by K. S. Bevis from J. chim. phys. 49, 103-8(1952). 11p.

When the vapor pressures of the two constituents of a binary mixture at a specific temperature are known as a function of the composition, it is easy to verify, numerically, the Margules-Duhem relation Σ NdLa = 0, where "N" is the molecular concentration of the constituents and 'a" their activity. A single function of the composition can be determined, from which the two vapor pressure (p) curves are determined. The calculations for water-HNO_3 mixtures at 20°C were made by employing the measurements made by R. Vandoni and Mme. M. Laudy. Verification is very good. (auth)

6754

ANALYTICAL REPRESENTATION OF ATOMIC SCATTERING FACTORS. V. Vand, P. F. Eiland, and R. Pepinsky (Pennsylvania State Univ., University Park). Acta Cryst. 10, 303-6(1957) Apr.

Atomic scattering factors can be expressed analytically by an expansion of Gaussian functions. A two-term expansion is sufficiently accurate to cover the Cu Kα range of scattering angles occurring in crystallographic calculations. For the Mo Kα range, one extra constant is to be added. The constants of the two-term expansion are evaluated for all the elements. The function fits the tabulated atomic scattering factors to better than 1% of f(0) in most cases. (auth)

6755

THE STRUCTURES OF $ZrGe_2$, $HfSi_2$, AND $HfGe_2$. J. F. Smith and D. M. Bailey (Iowa State Coll., Ames). Acta Cryst. 10, 341-2(1957) Apr.

6756

THERMOLUMINESCENCE OF FOURTEEN ALKALI HALIDE CRYSTALS. Louis F. Heckelsberg and Farrington Daniels (Univ. of Wisconsin, Madison). J. Phys. Chem. 61, 414-18(1957) Apr.

In this investigation the thermoluminescence glow curves of fourteen alkali halides from liquid air temperature to red heat were measured after exposure of the crystals to x or γ radiation. The effects produced by various amounts of radiation were studied using crystals of LiF and NaCl. The thermoluminescence of mixed crystals containing various alkali halides was also studied. (auth)

6757

THE HEAT OF COMBUSTION OF YTTRIUM. Elmer J. Huber, Jr., Earl L. Head, and Charles E. Holley, Jr. (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem. 61, 497-8(1957) Apr.

6758

FUSION POWER. THE PACE QUICKENS. Nucleonics 15, No. 5, 108(1957) May.

Recently released information on Project Sherwood is briefly summarized. (T.R.H.)

6759

THERMODYNAMIC PROPERTIES OF LIQUID HELIUM THREE. VAPOR PRESSURES BELOW 1°K. Stephen G. Sydoriak and Thomas R. Roberts (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 106, 175-82(1957) Apr. 15.

Vapor pressures of liquid He^3 have been measured between 0.45 and 1.0°K. Temperatures were measured by the paramagnetic susceptibility of either ferric ammonium or chrome methylamine alum. The salts were calibrated above 1°K against He^3 vapor pressures using the data of Abraham, Osborne, and Weinstock and the He^4 temperature scales of Clement (55E) and of van Dijk and Durieux (L55). The data obtained with the two salts were in good agreement with each other and indicate no preference between the two He^4 scales. In order to fit the data by a simple equation over the entire temperature range, explicit account had to be taken of the effect on the vapor pressure of the variation of the spin entropy, S_σ. An equation valid between the critical point and 0°K is $\ln p_{mm} = 2.5 \ln T_E + i_0 - (1/RT)\int_0^T S_\sigma dT - 2.53853/T_E - 0.20644 T_E + 0.07728 T_E^2 - 0.00919 T_E^3$, where i_0 is the vapor pressure constant, 5.31733, and the subscript E designates use of the 55E scale throughout the calibration and subsequent equation fitting. By this equation the latent heat at absolute zero is 5.044 cal/mole. Between 0.25°K and the critical point, 3.327°K, the entropy integral is fitted by the empirical equation, $(1/RT)\int_0^T S_\sigma dT = 0.5020 + 0.1786 \ln T - 0.00912 T^2$. (auth)

6760

THE EFFECTIVE ATOMIC NUMBER. T. Henriksen and J. Baarli (Norwegian Radium Hospital, Oslo). Radiation Research 6, 415-23(1957) Apr.

The effective atomic number for compounds is analyzed with the aim of being able to carry out calculations of Z-dependent effects as if the compound were a single element. Three different ways of defining $\bar{Z}$ are stated. The examination of these definitions shows that if the absorption of x- and γ-rays is studied no single fixed effective atomic number can be found for compounds, since the absorption is a combination of the three processes: photoelectric effect, Compton effect, and pair production. In spite of this it is possible to estimate an effective atomic number which can be of great value in order to solve some practical problems. As examples of this procedure the air equivalence of scintillation crystals for high-energy bremsstrahlung and wall effects of ionization chambers are chosen. The theory has been extended to include the adjustment of an atomic weight, W, to the defined effective atomic number, $\bar{Z}$. (auth)

6761

LIGHT SCATTERING BY COLLOIDAL SYSTEMS. AN ANNOTATED BIBLIOGRAPHY. Myer M. Fishman. River Edge, Technical Service Laboratories, 1957. 86p.

COSMIC RADIATION

6762

Be^7 CONTENT IN SNOW. Ragnar Nilsson, Kai Siegbahn, Adolf Berggren, and Bjorn Ingelman (Inst. of Physics and Pharmacia Ltd., Uppsala, Sweden). Arkiv Fysik 11, No. 5, 445-51(1957).

The radioactive isotope Be^7, which is produced in the atmosphere by cosmic radiation, has been extracted from collected snow samples by means of ion exchange. The intensity of the Be^7 radiation has been measured with a scintillation spectrometer. The average concentration of Be^7 atoms in the three snow samples was 4.3×10^3 atoms cm^3 (volume of water). (auth)

6763

ON THE COSMIC RAY PENETRATING SHOWERS UNDERGROUND. S. Higashi, T. Oshio, H. Shibata, K. Watanabe, and Y. Watase (Osaka City Univ., Japan). Nuovo cimento (10) 5, 592-6(1957) Mar.

In 218.5 h of receptive time, 13 penetrating showers were obtained with a large multiplate cloud chamber, at the depth

50 m w.e. from the top of the atmosphere. Five of these showers were produced in lead plates in the chamber. The rate of the number of penetrating showers produced by secondary rays (probably π mesons) to that by primary rays (probably μ mesons) is found to be $^2/_3 \sim {}^1/_1$. Therefore it seems impossible to neglect the contributions of secondary particles to the production of penetrating showers underground. The apparent cross section of μ mesons for the penetrating shower production is estimated as $(0.5 \pm 0.3) \times 10^{-30}$ cm^2/nucleon and the interaction mean free path of secondaries is (157 ± 90) g/cm^2. (auth)

6764

ON THE MULTIPLE PENETRATING PARTICLES UNDERGROUND. S. Higashi, T. Oshio, H. Shibata, K. Watanabe, and Y. Watase (Osaka City Univ., Japan). Nuovo cimento (10) 5, 597-607(1957) Mar.

Penetrating showers have been observed at the depth of 50 m w.e. from the top of the atmosphere by means of a large multiplate cloud chamber, the sensitive volume of which is $80 \times 70 \times 40$ cm^3 and which contains 15 lead plates of the thickness of 1 cm each. In 218.5 hours of receptive time, four events each involving from 4 to 9 parallel penetrating particles falling onto the cloud chamber simultaneously were observed in addition to a number of penetrating showers. The parallel penetrating particles show neither nuclear interaction with lead nuclei nor appreciable scattering in the lead plates. It is considered that these events consist of μ mesons having energies higher than 0.5 Bev at this depth. They were named the multiple penetrating particles (M.P.P.), about which following conclusions were obtained: i) If they are the secondary particles of large penetrating showers produced in the overlaying rock over the apparatus, the statistical hypothesis that the origin of the shower is within 6 m over the apparatus can be abandoned with a significant level smaller than 0.01. The multiplicity of π mesons produced in such a shower would be more than 300, even if all the secondaries, undergoing absorption with a mean free path $\lambda = 145$ g/cm^2 ($=2\lambda_{gr}$, λ_{gr}: geometrical interaction mean free path in rock), decayed into μ mesons. ii) If they belong to the penetrating component of air showers which traverse the earth down to this depth, the size and the frequency of those events cannot be interpreted on the assumption of the flat structure function of the penetrating component as usually employed. (auth)

6765

A POSSIBLE INTERPRETATION OF THE MULTIPLE PENETRATING PARTICLES. S. Hayakawa (Kyoto Univ., Japan). Nuovo cimento (10) 5, 608-14(1957) Mar.

Some of the multiple penetrating particles observed by Higashi et al., are regarded as a bundle of μ mesons produced in the atmosphere. It is suggested to interpret this observation in terms of the heavy primary nucleus that is split into nucleons by the collision with an air nucleus, each of the split nucleons producing multiple π mesons which subsequently decay into μ mesons of high energies. (auth)

6766

A CALCULATION ON THE STRUCTURE OF THE NUCLEONIC CASCADE IN THE ATMOSPHERE. M. Oda (Univ. of Tokyo). Nuovo cimento (10) 5, 615-27(1957) Mar.

Hypothetical models of the nucleonic cascade were used for interpreting cosmic ray air showers. Numerical calculations were made on energy and angular distributions of π mesons and μ mesons produced at each generation of the nucleonic cascade. The number of electrons and μ mesons at sea level and their lateral distribution are also derived. Assumptions on the nucleon-nucleus interaction are adjusted so that results of the calculation agree with experimental results on the air showers. (auth)

6767

OBSERVATION ON THE ENERGY SPECTRA OF MULTIPLY CHARGED NUCLEI IN THE COSMIC RADIATION. C. J. Waddington (H. H. Wills Physical Lab., Bristol). Nuovo cimento (10) 5, 737-8(1957) Mar.

In order to check the validity of the expression for the energy spectrum of multiply charged nuclei in the primary cosmic radiation, direct measurements were made of the energy spectrum. Measurements were made by comparing the integral energy spectrum of α particles in a particular stack of photographic emulsions with the spectrum obtained from higher charged nuclei observed in the same emulsions. (B.J.H.)

6768

INTENSITY VARIATION OF VERTICAL COSMIC-RAY AIR SHOWERS. K. Y. Shen and S. F. Singer (Univ. of Maryland, College Park). Phys. Rev. 106, 555-7(1957) May 1.

A new experimental approach has been studied for measuring the sidereal time variation of the high-energy cosmic radiation. The apparatus consists of an "air-shower telescope" using only six small counter tubes and an "extensive" tray of GM tubes. The apparatus is sensitive to vertical showers and discriminates against showers with (projected) zenith angle greater than 10°; this directional efficiency is calculated to be about 90% and has been verified experimentally. In subsidiary experiments, the apparatus has been used to measure the zenith angle dependence of air showers. An arrangement of counters can be set up to detect only vertical showers of high energy. Preliminary results show a counting rate of 1 per 3 hours per recording station for vertical extensive air showers of energy $\geq 10^{15}$ ev. The barometric coefficient has been determined as (9 ± 4)% per cm Hg; however, no statistically significant time variation has as yet been detected. The recording rate can be increased and better statistics obtained by increasing the number of recording setups. (auth)

6769

CHANGES IN THE LOW-ENERGY PARTICLE CUTOFF AND PRIMARY SPECTRUM OF COSMIC RAYS. Peter Meyer and J. A. Simpson (Univ. of Chicago, Ill.). Phys. Rev. 106, 568-71(1957) May 1.

The low rigidity cutoff for primary particles in the cosmic-ray spectrum reappeared in 1956. From these new results and the earlier measurements in 1948, 1951, and 1954, it is clear that the shift of the low-rigidity cutoff to a very small value is restricted in time to an interval within which solar activity reached a minimum in the 11-year solar cycle. This effect was accompanied by other changes in the primary spectrum; namely (a) the total cosmic-ray intensity and (b) the exponent for the power law spectrum, both passed through maxima near the solar minimum in 1954. The 1956 results further support the view that these changes in the primary spectrum have their origin in a mechanism controlled by solar activity—most likely the diffusion of cosmic-ray particles through interplanetary disordered magnetic fields transported by plasma clouds of solar origin. If this is so, then only for a brief period near solar minimum is there the possibility of access to the true galactic spectrum for particles below approximately 30 Bv. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

6770 NAA-SR-1839

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ELECTRONIC PROPERTIES OF Th, U, AND Pu. II. ENERGY BAND STRUCTURE OF METALLIC PHASES. Guy W. Lehman. May 1, 1957. 50p. Contract AT-11-1-GEN-8. $0.35(OTS).

A general method for computing the energy levels in the metallic phases of the actinide metals is presented. This approach is a simplification of the Slater-Koster interpolation scheme which is achieved by using a cellular method originally introduced by Kohn. Arguments are presented which show that the valence electrons of Th occupy the 6d band while those of U and Pu occupy the 5f and 6d bands. The energy matrix for the 6d band of $\alpha-$Th is constructed from Bloch sums formed from the ten 6d atomic orbitals appropriate when spin-orbit interaction is present. These matrix elements depend upon a single parameter, E_0, which is fixed by using the experimental electronic specific-heat data of Smith and Wolcott. The energy levels are doubly degenerate at every point in the zone in accordance with the group theoretical results of Elliott. The spin-orbit interaction is shown to modify the energy levels in a significant manner at points of high symmetry in the Brillouin zone. The accidental degeneracies which arise in the absence of spin-orbit coupling are completely removed by this interaction. Numerical results are presented for the lowest three bands in $\alpha-$Th, showing that the lowest band is completely occupied, the second band nearly filled, and the third band nearly empty. The total 6d band width is of the order of 3.4 ev. The effective mass concept is shown to hold. Eighteen pockets of holes are found; twelve of these lie along directions in the Brillouin zone equivalent to (011) while the remaining six lie along directions equivalent to (001). Similarly, nine electron pockets are found; eight of these occur along the directions equivalent to (111) and the remaining pocket is centered about (000). From these results, a density-of-states curve is obtained which is valid in the vicinity of the Fermi level. A brief description of the 5f band calculation for $\alpha-$U is given, showing that the energy matrix for this case is of order 28. The energy levels likewise depend upon the parameter E_0. No numerical results have been obtained as yet. (auth)

ELECTRICAL DISCHARGE

6771 AECU-3461

RAND Corp., Santa Monica, Calif.

THE CHARACTERISTIC ENERGY LOSS OF ELECTRONS PASSING THROUGH METAL FOILS. II. DISPERSION RELATION AND SHORT WAVE LENGTH CUTOFF FOR PLASMA OSCILLATIONS. Richard A. Ferrell. Dec. 28, 1956. 33p. For Univ. of Calif. Radiation Lab. Contract [W-7405-eng-48], Subcontract SC-101. (RM-1865-AEC; AD-112420). $6.30(ph OTS); $3.00(mf OTS).

Previous work is extended so as to provide a determination of the shortest wave length at which plasma oscillations can be sustained by a degenerate electron gas. The collective oscillations are treated without introducing collective coordinates, thereby avoiding possible complications associated with subsidiary conditions. Instead the Hartree self-consistent field method is used to provide a direct quantum mechanical analog to the Bohm-Gross derivation of the dispersion relation. The effect of electron exchange, calculated by replacing the Hartree by the Hartree-Fock method, somewhat decreases the dependence of the plasma frequency on wave number. The maximum wave number corresponds to the momentum just sufficient to cause an electron at the surface of the Fermi sea to make a real transition, absorbing one plasma quantum of energy. This criterion agrees well with Watanabe's measurement of the maximum angle by which electrons undergoing the characteristic energy loss are scattered. The previous work on the intensity of the characteristic energy loss as a function of angle is supplemented by a study near cutoff, where it is shown that the intensity drops rapidly to zero as the maximum angle of scattering is approached. (auth)

6772 NP-5448(3rd Ed.)

Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

BASIC DATA OF ELECTRICAL DISCHARGES. Technical Report No. 283. Third Edition. Sanborn C. Brown and W. P. Allis. Sept. 1, 1956. 110p. DA Projects 3-99-10-022 and 3-99-10-000. Contract DA36-039-sc-64637.

Data on various aspects of electrical discharges are summarized. These include data on potential energies, collision probabilities, surface phenomena, motions of electrons and ions, production and decay of ionization, breakdown, electron energies, and cathode phenomena. (B.J.H.)

6773 AEC-tr-2910

TEMPERATURE AND RADIATION MEASUREMENTS ON WATER-STABILIZED HIGH PRESSURE ARCS. T. Peters. Translated from Z. Physik 135, 573-92(1953). 20p.

A high pressure water-stabilized burning in a channel surrounded by water is described. This channel is produced by rotation of the pressure housing. The pressure is due to water vapor and can be raised to about 1000 atm for approximately 0.5 seconds at 100 kw/cm (200 amp 500 v/cm). Electron concentration and temperature are found with the help of the shape of the line of H_β. As the pressure is raised, the Balmer lines disappear up to H_α. The electron affinity spectrum (H^- continuum) becomes an increasingly significant portion of the Brems and recombination continua, as theoretically predicted. At maximum pressures absorption becomes so great that a nearly pure blackbody radiation is emitted of about 12000°K. (auth)

6774

LIMITATIONS OF THE MICROWAVE CAVITY METHOD OF MEASURING ELECTRON DENSITIES IN A PLASMA. K. B. Persson (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. 106, 191-5(1957) Apr. 15.

The limitations of the conventional microwave cavity method of measuring the electron density are derived. The conventional method permits the electron density to be measured over a range of approximately two decades. The upper limit of the measurement of the electron density, roughly 5×10^9 cm^{-3}, is caused by plasma resonance due to the macroscopic polarization of the plasma and by the overlapping from higher order modes. The lower limit of the measurement of the electron density, roughly 5×10^7 cm^{-3}, is determined by how accurately the resonant frequency can be measured. The macroscopic electric polarization can be eliminated and the overlapping modes suppressed by designing the cavity so that the probing microwave field and the plasma have rotational symmetry around the same axis. The electric polarization limit is then replaced by a magnetic polarization limit and the available range is increased approximately one additional decade at 3000 Mc/sec. By decreasing the frequency from 3000 to 1 Mc/sec and by measuring the Q or the losses of the plasma in a properly designed solenoid instead of a cavity the magnetic polarization limit can be raised even more. At 1 Mc/sec and at a pressure of 1 mm Hg the electron density corresponding to the magnetic polarization limit is 10^{15} to 10^{16} cm^{-3}. The lower limit for the measurable electron density or the conductivity is determined by the sensitivity of the detecting arrangement, and the noise originating in the electron-ion plasma and is probably 10^4 to 10^5 times less than the maximum measurable electron density. (auth)

6775

MICROWAVE MEASUREMENTS OF HIGH ELECTRON

DENSITIES. S. J. Buchsbaum and Sanborn C. Brown (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 106, 196-9(1957) Apr. 15.

The conventional microwave method for measuring plasma electron densities is limited in its validity to relatively low concentrations ($\sim 10^9$ cm^{-3}). Following a theoretical development by Persson, a method is presented whereby much higher densities can be measured. The method is based on eliminating the effect of ac space charge on the probing microwave field. This is accomplished by ensuring that the electric field be everywhere perpendicular to electron-density gradients. A discussion is presented on the effect of neighboring modes on the measuring mode in a microwave cavity. (auth)

ELECTRONS

6776 AERE-GP/M-196

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

ON THE POSSIBILITY OF PRODUCING RELATIVISTIC SELF-CONSTRICTED RING CURRENTS. J. D. Lawson. Jan. 1957. 19p.

Some of the problems likely to be encountered in setting up a relativistic self-constricted ring current of the form described by Budker are discussed. Two possible methods of approach are considered. The first of these is the "multiturn injection" method in which electrons of moderate energy are injected into a betatron type field, and then accelerated; the second is the "plasma" method, in which electrons are drawn from some form of ring plasma by means of an electric field. Order of magnitude calculations of space charge effects, gas scattering and various relaxation times are given. It is found that the beam changes its character when the number of electrons per unit length divided by the energy of the electrons expressed in terms of their rest mass exceeds the reciprocal of the classical electron radius. It is concluded that a number of challenging problems must be solved before such a beam can be established. (auth)

6777

POLARIZATION EFFECTS IN THE TWO-QUANTUM ANNIHILATION OF POSITRONS. Lorne A. Page (Univ. of Pittsburgh, Pa.). Phys. Rev. 106, 394-8(1957) May 1.

Computations of two-quantum annihilation-in-flight of a positron with an electron are made with little averaging of spins or summing of photon polarizations. For energies of a few Mev, strong departures are found from the better known situation at vanishing energy, as regards annihilation probability for parallel spins, the plane-polarization correlation, and the circular-polarization correlation. Production of a circularly polarized photon beam is discussed, as is longitudinal- or transverse-polarization analysis by a polarized electron target. (auth)

Refer also to abstracts 6948 and 6954.

GASES

6778

THERMAL CONDUCTIVITY OF BINARY AND TERNARY RARE GAS MIXTURES. B. N. Srivastava and S. C. Saxena (Indian Association for the Cultivation of Science, Calcutta). Proc. Phys. Soc. (London) B70, 369-78(1957) Apr.

The thermal conductivity of the binary gas mixtures Ne–A, Ne–Kr and A–Kr has been measured at 38°C for various concentrations by using the 'thick wire' variant of the 'hot wire' method. These data are likely to be of great use for gas analysis in the usual experiments on diffusion and thermal diffusion and have, therefore, been represented by semi-empirical equations giving the conductivity over the entire range of concentration. The experimental values of thermal conductivity have been compared with those calculated on the Lennard-Jones 12-6 model and the modified Buckingham exp-six model. A simple modification of the Lindsay–Bromley formula has been suggested and is found to reproduce the experimental data extremely well. The thermal conductivity of the ternary mixture Ne–A–Kr has also been measured for different compositions of the mixture. (auth)

Refer also to abstract 6975.

INSTRUMENTS

6779 AECU-3455

Sandia Corp., Albuquerque, N. Mex.

NOTE ON TRANSISTOR APPLICATIONS. T. E. Lommasson. Oct. 20, 1955. 9p. Contract [AT-(29-1)-789]. (TM-220-55-53). $1.80(ph OTS); $1.80(mf OTS).

It is well known that at low levels of d-c emitter current, the common base a-c short circuit current gain of a transistor decreases considerably. This paper points out where this effect may be of importance and derives approximate first order quantitative expressions which describe the circuit effects of this low level phenomenon. Applications of these data to practical "starved base" circuits, particularly silicon transistor circuitry, are developed. (auth)

6780 AERE-C/M-294

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

OPERATION OF THE MERVYN-HARWELL SQUARE WAVE POLAROGRAPH. L. E. Smythe. Dec. 20, 1956. 13p.

Details of all the controls of the square wave polarograph and instructions for taking a typical polarogram are described. (W.L.H.)

6781 AERE-G/R-168

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.]

THE DESIGN OF A.C. AMPLIFIERS FOR USE WITH IONISATION CHAMBERS. CONSIDERATIONS OF RESOLVING TIME AND SIGNAL TO NOISE RATIO. A. B. Gillespie. Feb. 24, 1948. 34p.

The problems involved in the choice of frequency band and design of input stage for a-c amplifiers to achieve a desired resolving power together with the optimum signal to noise ratio are discussed. It is shown that the resolving power of the amplifier is determined by the collection time of the ion chamber together with the position of the frequency band in the spectrum and that the best signal to noise ratio consistent with this resolving power depends on the operating conditions of the input tube. In particular, where the amplifier frequency band is determined by a single time constant of differentiation and one of integration these should be made equal, and from a knowledge of the chamber collection time, the position of the frequency band in the spectrum to give the desired resolution can be determined directly from a family of specially constructed curves. The optimum signal to noise ratio is then contained by adjusting the input valve operating conditions to make (if possible) the shot noise and the grid current noise rms voltages equal, when measured at the amplifier output, provided the larger noise component is reduced in the process. (auth)

6782 CF-57-4-97

Oak Ridge National Lab., Tenn.

THORIUM OXIDE SLURRY FALLING BALL VISCOMETER — FINAL CO-OP REPORT, WINTER, 1957. P. E. Novak. Apr. 10, 1957. 14p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A falling ball viscometer under development at ORNL, employing a flow system and an electromagnetically operated dash-pot pump, was evaluated for possible use with aqueous ThO_2 slurry systems under reactor irradiation. Interchangeable check valve inserts were designed and fabricated to investigate several pump designs. Magnetic flux concentrations which originally prevented circulation of the ferritic stainless steel viscometer ball through the electromagnetic pump were eliminated by substitution of iron-magnetic stainless steel inserts. Viscosity was correlated through a logarithmic plot of the dimensionless Reynolds number vs. Froude number with the ratio of ball diameter to tube diameter as a parameter. The relation is linear in the laminar flow region. (auth)

6783 IGR-TN/W-489

Gt. Brit. Windscale Works, Sellafield, Cumb., England.

GAMMA ABSORPTION TECHNIQUES APPLIED TO STEAM DRYNESS DETERMINATIONS. A. P. Dixon. Mar. 1957. 8p.

An instrument employing gamma-ray absorption techniques has been developed for measuring the steam–water ratio in a thick walled steel tube. The instrument was developed to enable this measurement to be made during heat transfer tests on an evaporator in which heat was transferred from sodium to high pressure water. The method depends on the change with steam content in the amount of absorption of soft gamma radiation passing through the tube. The limitations are examined and an instrument is described applying the method to estimate the steam content in the water flow in a $\frac{3}{4}$-in. nominal bore mild steel tube. The instrument is calibrated up to 2.5% steam by weight, the useful range in its present use, but methods of improving the performance are described and recommendations made. (auth)

6784 NP-6287

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

CATALOGUE OF ELECTRONIC EQUIPMENTS DESIGNED BY UNITED KINGDOM ATOMIC ENERGY AUTHORITY, ELECTRONICS DIVISION, A.E.R.E., HARWELL. Jan. 1957. 102p.

Amendments to this Catalogue to be issued periodically.

6785 UCRL-3609

California. Univ., Berkeley. Radiation Lab.

BEVATRON BEAM INDUCTION ELECTRODES. Harry G. Heard. Feb. 12, 1957. 23p. Contract W-7405-eng-48. $0.25(OTS).

A complete description is given of the nondestructive beam-induction electrode system used in the Bevatron to detect the magnitude and radial position of the primary proton beam. Design principles, frequency response, ultimate sensitivity, monitoring, and calibration techniques are disclosed. A brief account is given of the problems associated with the development of induction electrodes. A quarter-scale model was used to develope a special electrode configuration which yielded a sum signal independent (within 6%) of beam position, and a maximum-output signal for small deviations of the proton beam from the radial centerline of the aperture. The output signal of the beam-induction electrodes is monitored by a transistor connected as an emitter follower. The transistor is affixed to the induction electrode inside the vacuum tank of the Bevatron. An analysis is given which delineates the design principles involved in the transistor circuitry. (auth)

6786

REGULATION OF THE INDIVIDUAL DYNODE VOLTAGES FOR PHOTOMULTIPLIER TUBES. O. R. Harris (Univ. of Virginia, Charlottesville) and B. d'E. Flagge (National Advisory Committee for Aeronautics, Langley Field, Va.). IRE Trans. Nuclear Sci. NS-4, 3-11(1957) Mar.

An individual dynode voltage regulating system has been devised which can be mounted on the phototube socket in much the same manner as, and with no more difficulty than, the common bleeder resistance voltage divider. Two types of these regulators have been investigated; the first using silicon diodes, and the second using NE-2 neon tubes. The statistical spread of beta-ray counts was reduced from (±) six standard deviations to nearly the normal spread of (±) three standard deviations. The photometric sensitivity range of linearity was increased by an order of magnitude. (auth)

6787

PRECISION PULSE GENERATOR. Herman L. Miller (Dow Chemical Co., Denver, Colo.). IRE Trans. Nuclear Sci. NS-3, No. 3, 18-21(1956) June.

A pulse generator was developed for the range 10 to 100 volts to calibrate pulse height analyzers. Amplitude calibration depends on a standard cell. The generator can synchronize with power line frequency, an external oscillator, or furnish its own repetition rate. An advance pulse for triggering an oscilloscope is provided. (auth)

6788

ELECTRONICS AT THE FRENCH ATOMIC ENERGY COMMISSION. Mauric M. Sirdin. IRE Trans. Nuclear Sci. NS-4 34-9(1957) Mar.

This paper gives a description of the organization and functioning of the Electronic Division of the Atomic Energy Commission of France. The Division is organized into four sections, Physical Electronics, General Electronics, Industrial Electronics, and Radioactive Isotopes Measurement. The sections are subdivided into groups. There are approximately 200 persons in the Division. Descriptions are given in this paper of typical development projects and method of operation. Some examples of interesting instruments are given together with a brief description of their operation. (auth)

6789

PULSE AMPLITUDE SELECTOR WITH CONSTANT ANALYSIS TIME. Maurice Spighel and Louis Penege. J. phys. radium 18, Suppl. No. 3, 19A-22A(1957) Mar. (In French)

6790

A POSSIBLE FUSION REACTOR. Goro Miyamota, Giiti Iwata, Sigeru Mori, and Kenji Inoue (Univ. of Tokyo). J. Phys. Soc. Japan 12, 438(1957) Apr.

A mass spectrometer of perfect velocity focusing and total direction focusing for the solid angle 4π has been constructed and tested with electrons. Arguments are presented that this principle may be applicable to an apparatus for producing fusion reactions. (M.H.R.)

6791

IMPROVEMENTS ON A MULTICHANNEL PULSE ANALYZER. S. Colombo, C. Cottini, and E. Gatti (Lab. CISE, Milano). Nuovo cimento (10) 5, 748-50(1957) Mar.

Circuit diagrams are given for an improved multichannel pulse analyzer. The operation of the analyzer is also briefly reviewed. (B.J.H.)

6792

LOW TEMPERATURE MIXING CALORIMETER FOR LIQUIDS. J. Jeener (Univ. of Brussels). Rev. Sci. Instr. 28, 263-5(1957) Apr.

A technique is described for measuring the heat of mixing, excess volume, specific heat, and other thermodynamic properties of liquid systems at low temperature (e.g., CO, CH_4, A, Kr). Experiments are carried out at constant pressure, without any vapor phase in the calorimetric vessel. (auth)

6793

CRYOSTATS AND MECHANICAL STAGE FOR NUCLEAR MAGNETIC RESONANCE STUDIES. L. N. Mulay (Harvard Univ., Cambridge Mass.). Rev. Sci. Instr. 28, 279-82 (1957) Apr.

Cryostats for use with liquid helium and other coolants providing temperatures in the range 77° to 600°K constant to within ± 1° are described. These are designed to provide a self-contained probe with the facility of interchanging different radio-frequency coils. The rf coil is so mounted that it keeps the sample free from condensation of moisture at low temperatures and facilitates changing of samples without disturbing its position in the homogeneous region of the magnetic field. A mechanical stage which locates this region and clamps the probe in this position is also described. It reproduces this setting quickly and is particularly useful for high resolution studies. A new method of setting up the mechanical stage with the cryostat, the magnet, and the oscillator provides a compact assembly with considerable ease in their operation and allows the use of a very short coaxial cable (about 6 in.) for connecting the rf coil to the oscillator. This considerably improves the signal-to-noise ratio. (auth)

ISOTOPES

6794

APPLICATION OF NUCLEAR RECOIL TO THE PREPARATION OF RADIOACTIVE ISOTOPES WITHOUT A DRIVING DEVICE. J. Pauly and P. Sue. J. phys. radium 18, 22-6 (1957) Jan. (In French)

6795

ISOTOPE MILKER SUPPLIES Ba^{137} FROM PARENT Cs^{137}. R. L. Newacheck, L. J. Beaufait, Jr., and E. E. Anderson (Tracerlab, Richmond, Calif.). Nucleonics 15, No. 5, 122-5(1957) May.

A device for supplying a convenient source of short-lived isotopes such as Ba^{137} from Cs^{137} is described. It uses ion-exchange separation and an automatic mechanical injection system to supply repeated amounts of a short-lived gamma emitter from a long-lived parent. (T.R.H.)

6796

ISOTOPE EFFECT BY PASSAGE OF CURRENT IN MOLTEN LITHIUM METAL. A. Lundén, A. Lodding, and W. Fischer. Z. Naturforsch. 12a, 268-9(1957) Mar. (In German)

ISOTOPE SEPARATION

6797

PRELIMINARY REPORT ON AN ELECTROMAGNETIC ISOTOPE SEPARATOR. Jun Okano (Osaka Univ.). J. Phys. Soc. Japan 12, 390-400(1957) Apr.

As a first step towards constructing a high intensity electromagnetic isotope separator, the focussing characteristics of the Smythe type magnetic lens was investigated. For preliminary experiments of isotope separation, a small mass separator of this type was constructed. The apparatus has an ion radius of 50 cm in the magnet, and has two ion sources which can be operated independently and simultaneously. The ion source was a sort of Finkelstein type and its characteristics were investigated in conjunction with the electrostatic lens system. The maximum ion current on the collector that was attained was about 400μa and 1 ma for neon and for magnesium respectively. (auth)

MATHEMATICS

6798 CF-57-4-96

Oak Ridge National Lab., Tenn.

DEFLECTION EQUATIONS FOR VARIOUS LOADINGS OF CIRCULAR-ARC CURVED BEAMS. D. L. Platus and B. L. Greenstreet. Apr. 22, 1957. 21p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

In analyzing stresses, deflections, and forces in piping and certain structural systems, it is useful to have a set of equations giving the deflections at any point of a curved beam in terms of the various loads acting on the beam. This paper presents the deflection equations for a curved circular-arc beam of variable length. The cases treated include in-plane and out-of-plane bending due to forces and moments applied to the end of the beam in three principal directions, and uniformly distributed loads applied along the beam in these three directions. Deflections were calculated by the strain energy method using Castigliano's theorem. (auth)

6799 NAVORD-5326

Naval Ordnance Test Station, Inyokern (China Lake), Calif.

USE OF THE 701 COMPUTER FOR COMPLICATED THERMODYNAMIC EQUILIBRIA CALCULATIONS. Period Covered: October 1955 to August 1956. D. S. Villars. Oct. 16, 1956. 24p. (NOTS-1574).

A procedure for rapidly solving complicated thermodynamic equilibria on the IBM 701 Calculator by a flexible iteration method was developed which can be readily extended to include additional (chemical) elements. In a sample problem, this procedure gave final concentrations which reproduce the equilibrium constants as closely or better than those obtained by earlier methods. In the new method, changes in composition are computed for only one reaction at a time, neglecting the interaction of such changes in composition on the other equilibria. After computing the changes successively for each of the important reactions, the calculations are repeated until the sum of absolute values of changes per round becomes less than an error, E, specified as a parameter of the problem. A subiteration procedure was utilized for solving the individual equations. This converges upon the solution by halving successive test intervals. The number of main iterations required depends upon the values of the equilibrium constants and the accuracy specified. For one set of parameters (JPN at 4000°K and 2 atm), the solution was completed in 19 main iterations; for another set (JPN at 2500°K and 2 atm), 181 main iterations were required. These were completed in 1.8 min. (auth)

6800 RM-1724(RAND)

RAND Corp., Santa Monica, Calif.

SOME PHYSICAL QUALIFICATIONS FOR RELIABILITY FORMULAS. W. J. Howard. June 1, 1956. 27p. (AD-109936).

This memorandum is an extension of an earlier RAND study, which analyzed the effect of complexity on the reliability of a chain. The chain was taken as the simplest example of a complex mechanism—one composed of a number of similar components. Using the stress-strength method of analysis developed in the earlier study, RM-1058, Chain Reliability: A Simple Failure Model for Complex Mechanism, the present study investigates the effects of operating time and redundancy on reliability. The formulas generally

used to represent the effects of operating time and redundancy on reliability are found to hold only under certain conditions regarding the stresses and strengths. Where they do not hold, the formulas tend to be somewhat pessimistic as regards decrease of reliability with time and complexity, and optimistic as regards redundancy. Approximate formulas for reliability as a function of complexity, redundancy, and time are determined for various stress-strength conditions; and the merits of using redundancy at different levels of system subdivision are considered briefly. (auth)

6801 WAPD-PM-42
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
CLOUDY CRYSTAL BALL. Judith A. Gund. Mar. 1956. 13p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40 (mf OTS).

The Cloudy Crystal Ball code for UNIVAC is developed. This code allows the calculation of many gross nuclear structure cross sections by the methods of Feshbach, Porter, and Weisskopf. The observable quantities used are the total and elastic scattering cross sections. (D.E.B.)

6802 WAPD-TM-33
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
ENSIGN CODE. B. L. Anderson, H. Bohl, Jr., E. M. Gelbard, and E. H. Stoves. Jan. 1957. 20p. Contract AT-11-1-GEN-14. $0.20(OTS).

The Ensign Code is a fixed point version of the Li'l Abner Code with the balance check method for crossing internal boundaries as the only analytic change. As the code is set up, it will handle symmetric slabs, unsymmetric slabs, and cylinders. Then any of the following variations may be included in the problem: cell, extrapolation factor, point-wise convergence, and restart. (auth)

6803
AN INTRODUCTION TO DIGITAL COMPUTERS. Nucleonics 15, No. 5, 54-5(1957) May.

The general arrangement and organization of a digital computer are briefly described. (T.R.H.)

6804
THE ROLE OF DIGITAL COMPUTERS IN NUCLEAR DESIGN. Ward C. Sangren (General Dynamics Corp., San Diego, Calif.). Nucleonics 15, No. 5, 56-60(1957) May.

The importance of digital computers in nuclear reactor design is demonstrated by the numerous codes that have been devised. A classification system for a bibliography of codes for nuclear reactor problems is described and discussed. Also discussed are computer availability, capabilities, personnel, and economics. (T.R.H.)

6805
CONTROL ANALYSIS WITH A DIGITAL COMPUTER. P. R. Hill and W. Thad Lee (Glenn L. Martin Co., Baltimore, Md.). Nucleonics 15, No. 5, 61-3(1957) May.

An analog device and a digital computer were compared in the selection of a control system for the Martin Power Reactor. It was concluded that the analog, because of its flexibility, could best be used for early exploratory analysis; corrections, refinements, and a re-check could be added by a digital program. (T.R.H.)

6806
MONTE CARLO SOLVES REACTOR PROBLEMS. Melvin H. Kalos and Herbert S. Wilf (Nuclear Development Corp. of America, White Plains, N. Y.). Nucleonics 15, No. 5, 64-8(1957) May.

The Monte Carlo technique, used for solving problems involving neutron transport, is described, and its advantages, disadvantages, and applications are discussed. Its use is demonstrated with a sample problem. (T.R.H.)

6807
DIGITAL COMPUTER USE IN THE NUCLEAR FIELD. Nucleonics 15, No. 5, 69(1957) May.

A tabulation is presented of the digital computers now in use by various organizations, and their future computer acquisition plans are given. (T.R.H.)

6808
INTRODUCTION TO ANALOG COMPUTERS. Nucleonics 15, No. 5, 70-1(1957) May.

The mode of operation and control of analog computers is described. (T.R.H.)

6809
ANALOG COMPUTATION IN NUCLEAR ENGINEERING. S. O. Johnson and J. N. Grage (Westinghouse Electric Corp., Pittsburgh). Nucleonics 15, No. 5, 72-5(1957) May.

The capabilities, advantages, and limitations of analog computers are described and discussed. (T.R.H.)

6810
DYNAMIC SIMULATION OF A FAST REACTOR. R. G. Olson (Atomic Power Development Associates, Inc., Detroit, Mich.). Nucleonics 15, No. 5, 76-9(1957) May.

The analysis of a startup accident and a loss-of-pump-power accident in a fast reactor by an analog computer is described to demonstrate the utility of analogs as reactor simulators. (T.R.H.)

6811
PWR TRAINING SIMULATOR. J. P. Franz and W. H. Alliston (Westinghouse Electric Corp., Pittsburgh). Nucleonics 15, No. 5, 80-3(1957) May.

6812
ANALOG STUDY OF BOILER-REACTOR INTERACTION. E. F. Borner and B. F. Cassidy (Knolls Atomic Power Lab., Schenectady, N. Y.). Nucleonics 15, No. 5, 84-8(1957) May.

The use of analog computers is demonstrated in determining the effects of boiler steam demand and feedwater stability on reactor operation. (T.R.H.)

6813
ANALOG COMPUTER USE IN THE NUCLEAR FIELD. Nucleonics 15, No. 5, 88(1957) May.

A brief tabulation of organizations using analog computers and their future plans are given. (T.R.H.)

MEASURING INSTRUMENTS AND TECHNIQUES

6814 CREL-605 (Rpt: UNCLASSIFIED)
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
TRANSISTOR CIRCUIT DESIGN FOR A RADIOACTIVITY CONTAMINATION METER. F. S. Goulding. Feb. 26, 1957. 34p. (AECL-435).

This report describes the design of circuits used in a portable geiger counter contamination meter. Brief reference is also made to the mechanical design of the instrument. In view of the lack of published information on the general problems of choice of components for miniaturized transistor circuits, some comments on the choice of components are included in this report. (auth)

6815 NP-6279 (Rpt: UNCLASSIFIED)
Brussels. Centre D'Etudes Pour Les Applications de l'Energie Nucleaire.
SUR LA DETERMINATION DE LA DENSITE EN NEUTRONS THERMIQUES D'UN MILIEU UNIFORME. NOTE METHODOLOGIQUE SUR L'EMPLOI DES EMULSIONS NUCLEAIRES. (On the Determination of the Thermal Neutron Density of a Uniform Medium. Methodological

Note on the Use of Nuclear Emulsions). C. Beets and H. Breny. June 15, 1956. 50p. (B-5).

An examination was made of the possibilities of the use of boron charged nuclear emulsions for the measurement of the thermal neutron density in a medium where they are uniformly distributed. (B.J.H.)

6816 NP-6281

Brussels. Centre D'Etudes Pour Les Applications de l'Energie Nucleaire.

MESURE DE L'ACTIVITE DES POUSSIERES EN SUSPENSION DANS L'AIR. (Measurement of the Activity of Dusts in Suspension in Air.) R. Boulenger. July 6, 1956. 11p. (B-1242).

6817 NP-6282

Brussels. Centre D'Etudes Pour Les Applications de l'Energie Nucleaire.

STANDARDISATION DES MESURES DU FOND CONTINU RADIOACTIF. (Standardization of the Measurements of Continuous Radioactive Background.) C. Godeau. June 22, 1956. 41p. (B-1243).

6818 ORNL-2298

Oak Ridge National Lab., Tenn.

RESPONSE OF THE ANTHRACENE SCINTILLATION COUNTER TO LOW ENERGY ELECTRONS. Lloyd W. Johnston, R. D. Birkhoff, J. S. Cheka, H. H. Hubbell, and B. G. Saunders. May 9, 1957. 46p. Contract W-7405-eng-26. $0.35(OTS).

Crystals of 0.060- and 0.011-inch thickness with a conical reflector to prevent loss of light were used. For electrons of energies ranging from 10 to 120 kev, the pulse height response is linear with energy within experimental error. The shape of the pulse height distribution curve closely approximates a Gaussian, and there is a linear relationship between energy and the square of the half widths at 1/e. The average amounts of energy required to produce a photoelectron, as calculated from these experiments, were 1.47 and 1.31 kev for crystals of 0.060 and 0.011-inch thickness, respectively. (M.H.R.)

6819 UCRL-3434

California. Univ., Berkeley. Radiation Lab.

SCINTILLATION DETECTION OF VERY-LOW-ENERGY GAMMA RAYS. J. C. Hubbs and W. A. Nierenberg. June 4, 1956. 7p. Contract W-7405-eng-48. $0.15(OTS).

A method is reported for the detection of very-low-energy γ rays. The method utilizes scintillation detection with NaI-Tl crystals especially split and mounted for the work, and selected single 5819 or 6292 photomultipliers. Typical performance is unit (2π) efficiency with background of 1 count per minute for γ energies between 5 and 100 kev. (auth)

6820 AEC-tr-2915

STUDY, WITH A PHOTOMULTIPLIER, OF THE LIGHT PULSES PRODUCED IN THE GAS OF A PROPORTIONAL COUNTER. G. Charpak, G.-A. Renard. Translated by K. S. Bevis from J. phys. radium 17, 585-6(1956). 4p.

An Abstract of this paper appears in Nuclear Science Abstracts as NSA-10:10338. (C.H.)

6821

DOSIMETRY OF MULTIPLE RADIATION FIELDS BY SUPERPOSITION OF PHOTOGRAPHIC FILMS. Robert Loevinger and Jacob Spira (Mount Sinai Hospital, New York). Am. J. Roentgenol. Radium Therapy Nuclear Medicine 77, 869-72(1957) May.

6822

IDENTIFICATION OF FAST CHARGED PARTICLES IN NUCLEAR EMULSIONS. T. Johansson and K. Kristiansson (Univ. of Lund, Sweden). Arkiv Fysik 11, No. 5, 467-79(1957).

Photometric grain density measurements have been made on tracks of singly charged particles not stopping in the emulsion. The method to identify particles by determining the grain density and the rate of change of grain density along the track has been studied. The method can be used for particle identification on gray tracks with $\beta \leq 0.65$. Systematic errors and errors from the statistical distribution of the grains in the tracks have been investigated. The method is less accurate than the scattering-grain density method, but it can be used as a complement to this method when unexpected results are obtained or when distorsion makes scattering measurements unreliable. (auth)

6823

NEW EQUIPMENT FOR THE STUDY OF THE RADIOACTIVE CLOUD. Hubert Garrigue. Compt. rend. 244, 2249-51(1957) Apr. 24. (In French)

A light vehicle was equipped for rapid measurements in the field. First results show fairly intense β activity from samples of April 6 and 7, 1957 and residual long-lived β activity from older samples. (tr-auth)

6824

RECENT NEUTRON DETECTOR STUDIES AT ARGONNE NATIONAL LABORATORY. G. F. Erickson, S. G. Kaufmann, and L. E. Pahis (Argonne National Lab., Lemont, Ill.). IRE Trans. Nuclear Sci. NS-3, No. 3, 8-10(1956) June.

A neutron sensitive photomultiplier tube has been built and tested in line with a program to investigate unconventional mechanisms of neutron detection. A fission counter following established principles has been designed with emphasis on minimum demands on skill and labor during construction and assembly, and minimum over-all cost. (auth)

6825

DETERMINATION OF NEUTRON INTENSITY AND GAMMA SPECTRUM OF NEUTRON SOURCES. L. B. Gnagey (Monsanto Chemical Co., Miamisburg, Ohio). IRE Trans. Nuclear Sci. NS-3, No. 3, 11-14(1956) June.

A very general discussion on the determination of neutron intensity and a gamma spectrum is given. The use and determination of secondary standards for neutrons and the design and resolution of the scintillation spectrometer for determination of the gamma spectrum are discussed. (M.H.R.)

6826

FACTORS AFFECTING THE APPLICATION OF HALOGEN-QUENCHED G-M TUBES. Walter G. Egan (Naval Shipyard, Brooklyn, N. Y.). IRE Trans. Nuclear Sci. NS-3, No. 3, 22-4(1956) June.

Pulses obtained from halogen-quenched G-M tubes operated under minimum circuit loading conditions were investigated. Oscillograms are shown and pulse characteristics discussed. The data show that the plateau obtained is determined, in part, both by the pulse shapes and by the electrical characteristics of the associated equipment. Spurious peaks in the halogen-quenched pulses occurring at normal operating voltages may be registered as counts, at certain voltage discrimination levels and circuit resolving times. This is of practical importance in radiation measurements. (auth)

6827

IONIZATION CHAMBER SURVEY INSTRUMENT. W. A. Higinbotham and B. Pollock (Brookhaven National Lab., Upton, N. Y.). IRE Trans. Nuclear Sci. NS-4, 1-2(1957) Mar.

A wide range survey instrument is described. Ranges are 20 mr/hour to 20 r/hour full scale. The thin plastic ionization chamber is easily replaced if contaminated. A three-

tube, negative feedback circuit with low battery drain is used. The input resistor selector switch is a new design with high insulation. It is nonmicrophonic and does not cause transients when changing ranges. (auth)

6828

A SELF-CHECKING RADIATION MONITOR. K. C. Speh and W. E. Landauer (Airborne Instruments Lab., Mineola, N. Y.). IRE Trans. Nuclear Sci. NS-4, 19-25(1957) Mar.

A self-checking system of circuits is expected to provide a new high in operational reliability for the set of radiation monitors described. Developed under sponsorship of the Bureau of Ships, these monitors can readily be adapted for application in any nuclear installation where radiation monitoring must be performed. Three basic channels are provided to measure accurately the gamma radiation in the range from 1 to 1000 mr/hr, the thermal neutron flux from 20 to 20,000 thermal neutrons/cm^2 sec, and the air-particle concentration from 10^{-9} to 10^{-6} $\mu C/cm^3$ or from 10^{-8} to 10^{-5} $\mu C/cm^3$. Checking of each channel is performed by periodically (and automatically) placing a small radioactive source next to the detecting element in each channel. This results in a signal near the maximum range of each channel. During such checks, the alarm-indicating circuit is disconnected and the channel output applied to a comparator circuit; there will result a "circuit fault" indication if any part of the signal-handling or the checking circuits has failed. The philosophy and the limitations of the checking scheme are discussed. The calibration of the air-particle channel is in terms of a specific isotope. Calibrations for other isotopes can be prepared. Shielding is applied to the detecting element in the air-particle channel in order to minimize counts due to the ambient gamma background. The gamma detector has shielding to equalize its response to radiation at energies between 80 kev and 2 mev. (auth)

6829

PROTON RECOIL PROPORTIONAL COUNTER FOR FAST NEUTRON SPECTROMETRY. P. Marguin and M. A. Moussa. J. phys. radium 18, Suppl. No. 3, 1A-9A(1957) Mar. (In French)

6830

AN APPARATUS WITH LOGARITHMIC SCALE FOR THE MEASUREMENT OF γ-RAY INTENSITY. Robert Genin. J. phys. radium 18, Suppl. No. 3, 36A-8A(1957) Mar. (In French)

6831

SCINTILLATION SPECTROMETER FOR THE STUDY OF α, β, AND γ RAYS IN COINCIDENCE. R. Foucher, L. Dick, N. Perrin, and H. Vartapetian. J. phys. radium 18, Suppl. No. 3, 54A-7A(1957) Mar. (In French)

6832

REALIZATION OF A NEW TYPE OF SELF-OPERATED WILSON CHAMBER AT VARIABLE PRESSURE. Tosiko Yuasa. J. phys. radium 18, Suppl. No. 3, 58A-9A(1957) Mar. (In French)

6833

LOW-BACKGROUND COUNTER FOR SOLID β-EMITTING SAMPLES. S. D. Softky and R. E. Nather (Tracerlab, Inc., Richmond, Calif.). Nucleonics 15, No. 5, 90, 92-3(1957) May.

A counting arrangement which employs Epon resin for the central counter body surrounded by an anticoincidence "umbrella" of 11 G-M tubes is described. The photosensitivity and "memory effect" of Epon resin were eliminated by adding lampblack. The standard deviation of the backgrounds observed was 0.01 cpm reflecting a limit of sensitivity of 0.05 cpm for the assembly. (T.R.H.)

6834

RARE-EARTH SOLUTIONS FOR 4π COUNTING. Juan Pascual and Edward C. Freiling (U. S. Naval Radiological Defense Lab., San Francisco, Calif.). Nucleonics 15, No. 5, 94(1957) May.

A method of preparation of solid-free solutions for rare-earth absolute-disintegration-rate determinations by 4π counting is described. (T.R.H.)

6835

SCINTILLATION DOSE-RATE METER IS RELIABLE, EASY TO MAINTAIN. W. G. Spear (Hanford Atomic Products Operation, Richland, Wash.). Nucleonics 15, No. 5, 96-101(1957) May.

A portable scintillation β-γ exposure-rate meter employing a Dumont 6291 photomultiplier and a crushed anthracene crystal weighing 200 mg/cm is described. The circuitry allows the use of a standard 36-megohm input resistor. For measurements not over 15 or 20 min the sensitivity may be increased to 1 or 2 mr/hr full scale on the 0 to 10 mr/hr range with stabilized zeroing. (T.R.H.)

6836

PROGRAMING DIGITAL REGISTER FOR AUTOMATIC COUNTING PLOTS. D. S. Harmer and R. A. James (Univ. of California, Los Angeles). Nucleonics 15, No. 5, 102-7 (1957) May.

The circuit, operation, and applications of the programing digital reader (PDR) are described. This device eliminates hand-plotting of counting data, and the circuit has a stability and accuracy of readout equivalent to hand-plotting the data on a similar scale. Drift and calibration problems are eliminated. (T.R.H.)

6837

A GEIGER COUNTER DESIGN GIVING A DEFINITE COUNTING LENGTH. P. J. Grouse and H. D. Rathgeber (Univ. of Sidney, Australia). Nuovo cimento (10) 5, 707-16(1957) Mar.

A design is given for a Geiger counter which is simple to make and the effective length of which is readily obtainable from its geometry and operating voltage. The results of field calculations and measurements agree. The operating voltage is chosen such that variations of effective length due to voltage fluctuations are minimized. (auth)

6838

MEDIUM-ENERGY NEUTRON TIME-OF-FLIGHT SPECTROMETER. R. Grismore and W. C. Parkinson (Univ. of Michigan, Ann Arbor). Rev. Sci. Instr. 28, 245-53 (1957) Apr.

A neutron time-of-flight spectrometer developed for the 1- to 20-Mev region is described. The instrument makes use of the phase bunching of deuterons in the Michigan 42-inch cyclotron and an external beam pulsing system to provide isolated bursts of neutrons of 4-mμsec time duration. Flight times are measured with an improved version of the chronotron capable of a precision of $\pm 3 \times 10^{-10}$ sec. The energy spread for a 5-meter flight path varies from 3.5% at 0.5 Mev to 10% at 20 Mev. The available neutron flux permits an improvement of at least a factor of three by lengthening the flight path. The $Be^9(d,n)$ thick target and the $O^{16}(d,n)$ thin target spectra are discussed. (auth)

6839

ZENITH ANGLE SENSITIVITY OF A CUBICAL MESON TELESCOPE. N. R. Parsons (Dept. of External Affairs, Melbourne). Rev. Sci. Instr. 28, 265-6(1957) Apr.

Diagrams are presented showing the variation of relative sensitivity with zenith angle for a vertically directed cubical meson telescope of the type recommended as standard equipment for the International Geophysical Year. (auth)

6840

SOME PROPERTIES OF A MODIFIED SOLENOID β SPECTROMETER WITH ZERO FIELD AT THE SOURCE. Y. Ramberg and A. E. Blaugrund (Weizmann Inst. of Science, Rehovoth, Israel). Rev. Sci. Instr. 28, 286-7 (1957) Apr.

The resolving power of a long magnetic lens using a field that rises linearly from a zero value at the source and becomes constant at a distance z_0 has been calculated as a function of z_0 for two emission angles 26.5° and 31°. For z_0 smaller than the radius of the spectrometer the resolving power remains nearly equal to that of a uniform field lens and then deteriorates quickly for values of z_0 greater than the radius of the spectrometer. The first-order spherical aberrations as well as the location of the ring focus and the detector are given graphically as functions of z_0. (auth)

6841

LIQUID SCINTILLATOR FOR THE ANALYSIS OF TRITIUM IN WATER. Frank E. Kinard (E. I. du Pont de Nemours & Co., Aiken, S. C.). Rev. Sci. Instr. 28, 293-4(1957) Apr.

A recipe is given for a liquid scintillator which is capable of dissolving up to 7% by volume of H_2O and has a high sensitivity for tritium in H_2O. The solvent consisted of xylene, 1,4-dioxane, and ethanol. The solute consisted of naphthalene, 2,5-diphenyloxazole, and α-naphthylphenyloxazole. Some data are included on the performance of the scintillator. (B.J.H.)

6842

STANDARD MEASUREMENTS OF RADIOACTIVITY AT THE NATIONAL PHYSICAL LABORATORY. W. E. Perry. Strahlentherapie 102, 370-8(1957) Mar. (In German)

The paper describes the main features of the methods used at the National Physical Laboratory for absolute measurements of the disintegration rates of samples of artificially produced radioactive nuclides by 4 π β counting, β-γ coincidence counting, 4 π β-γ coincidence counting and γ-ray ionization measurements. The procedure for the preparation and calibration of N.P.L. standards of Na^{24}, P^{32}, I^{131} and Au^{198} is described and the results of measurements of these standards, and samples of other nuclides, are reviewed. (auth)

MESONS

6843

THE MASSES OF LIGHT MESONS, K-MESONS AND HYPERONS IN 1956. K. M. Crowe (Stanford Univ., Calif.). Nuovo cimento (10) 5, 541-61(1957) Mar.

A number of independent accurate measurements of the masses of light mesons are critically reviewed. Assuming the positive- and negative-charged mesons to have equal masses, best values for the pion and muon masses can be calculated. It is found that the negative π- and μ-mesic x-ray energies measured by K absorption edges can be combined with the mass difference between the positive pion and muon to give a result with a standard deviation approximately one third of the assigned errors of the best previous measurement. All the results are in satisfactory agreement and can be combined in the usual way. The mass results are as follows: $M_\mu = (206.86 \pm 0.11)\ m_e$; $M_\pi = (273.27 \pm 0.11)\ m_e$. Experimental data on the mean lives, spins, parities, and decay modes are also reviewed and the results are given. The measurements of the masses of the various K mesons are obtained several ways: $M_{K_{\pi 2}} = (966.0 \pm 1.5)\ m_e$; $M_{K_{\mu 2}} = (965.3 \pm 1.9)\ m_e$; $M_\tau = (966.8 \pm 0.4)\ m_e$. There is at present no evidence for a difference in the masses to a precision of 1 + 2 m_e. Results on the $K^+_{\tau 2}$ and τ^+ masses and lifetimes and the analysis of τ^+ decay are discussed. At present the experimental equality of these particles seems to be contradictory to assigning a spin of less than 2. The cosmic-ray data on the θ^0 lifetime are reviewed and recent results on artificially-produced θ^0's are discussed. The hyperon mass data are reviewed. $M_{\Lambda^0} = (2181.74 \pm 0.35)\ m_e$; $M_{\Sigma^0} = (2327.4 \pm 1.0)\ m_e$. The latest data on a $\Sigma^+ - \Sigma^-$ mass difference and their mean lives are presented. (auth)

6844

ON THE SPIN OF THE $K_{\mu 3}$ MESON. L. A. Radicati and S. Rosati. Nuovo cimento (10) 5, 729-31(1957) Mar.

Results are presented of a calculation of the momentum spectra of the μ meson resulting from the decay $K_{\mu 3} \rightarrow \pi + \mu + \gamma$. These spectra are shown graphically. The spin of the $K_{\mu 3}$ meson can then be determined from the momentum spectrum. (B.J.H.)

6845

ON THE Σ HYPERON-NUCLEON INTERACTION CROSS-SECTION. N. Dallaporta and F. Ferrari. Nuovo cimento (10) 5, 742-5(1957) Mar.

Expressions are derived for the ratio of the production probabilities of Λ and Σ hyperons in the capture of K^- mesons at rest by nucleons. The relationship of this ratio to the scattering cross sections of Σ hyperons by nucleons is also discussed. (B.J.H.)

6846

THE MASS DIFFERENCE BETWEEN THE Σ^+ AND Σ^- HYPERONS. R. C. Kumar, W. B. Lasich, and F. R. Stannard (Univ. Coll., London). Nuovo cimento (10) 5, 746-7(1957) Mar.

The mass difference between the Σ^+ and Σ^- hyperons was studied by the reaction $K^- + p \rightarrow \Sigma^+ + \pi^- + Q_1$ and $K^- + p \rightarrow \Sigma^- + \pi^+ + Q_2$ in nuclear emulsions. Observations made on a stack of 600 μm plates exposed to the K^- beam of the Bevatron are reviewed. Results show a mass difference $M_{\Sigma^-} - M_{\Sigma^+} = (14.1 \pm 2.3)\ m_e$. (B.J.H.)

6847

ANGULAR DISTRIBUTION OF THE μ-DECAY AS TEST OF PARITY CONSERVATION. N. N. Biswas, M. Ceccarelli, and J. Crussard. Nuovo cimento (10) 5, 756-7(1957) Mar.

It has been predicted that certain asymmetries will occur in the π-μ-e decay if parity is not conserved. In order to study this effect, observations of π-μ-e events in nuclear emulsions were made. Data are included on the distribution of the spatial angle between the directions of emission of the μ meson and the electron. The evidence strongly indicates that an asymmetry in the π-μ-e decay does exist. (B.J.H.)

6848

CHANGE OF ISOTOPIC SPIN IN THE $K_{\pi 2}$ DECAY. M. Gell-Mann (California Inst. of Tech., Pasadena). Nuovo cimento (10) 5, 758-60(1957) Mar.

Various rules which have been suggested for the change of isotopic spin in the $K_{\pi 2}$ decay are briefly examined. (B.J.H.)

6849

LIFETIME OF THE NEUTRAL PION. G. Harris, J. Orear, and S. Taylor (Columbia Univ., New York). Phys. Rev. 106, 327-9(1957) Apr. 15.

A new upper limit on the π^0 lifetime has been obtained by using 12 $K_{\pi 2}$ endings in nuclear emulsion where the π^0 decays by a direct pair, $\pi^0 \rightarrow (e^+ + e^-) + \gamma$. The distance traveled by the π^0 before decay was measured from the intersection of the K^+ and π^+ tracks to the intersection of the pair and π^0 (colinear with π^+). The inherent accuracy of the measuring technique was found to be ~0.5 micron per event by using τ^+ secondaries as mock events. With the statistics of 12 events it should be possible to detect a π^0

decay length of ~0.2 micron or greater. Our data give no indication of a displacement of pair origins from the K endings. Thus the π^0 decay length is probably less then ~0.2 microns. This corresponds to a lifetime of less than 5×10^{-16} sec. Information on the upper limit of the π^0 lifetime is obtained from a plot of the likelihood function vs π^0 lifetime. The likelihood function is down by a factor of 30 for a lifetime of 1×10^{-15} sec and is rapidly decreasing for longer lifetimes. (auth)

6850

ISOBAR MODEL FOR MESON PRODUCTION IN PROTON-PROTON COLLISIONS. Saul Barshay (Univ. of California, Berkeley). Phys. Rev. 106, 572-85(1957) May 1.

A model is considered for single- and double-pion production in which the production takes place via an intermediate state wherein either one or both of the initial nucleons is excited to the isobaric state of $J = I = 3/2$. The treatment is phenomenological and comparison is made with recent experiments in the 0.5- to 1.5-Bev range. Two striking features of the experiments, the strong preference for the emission of mesons with kinetic energies of 50 to 150 Mev, and the rapid increase in the two-meson processes at bombarding energies above 1 Bev, are exhibited by the calculation. (auth)

6851

RELATION BETWEEN SCATTERING AND ABSORPTION IN THE PAIS-PICCIONI PHENOMENON. Myron L. Good (Univ. of California, Berkeley). Phys. Rev. 106, 591-5(1957) May 1.

The expressions for the θ_1 and θ_2 amplitudes in a beam of neutral θ mesons traversing an absorber are put in terms of forward-scattering amplitudes. It is discovered that a phase-shift term as well as an absorption term is needed to describe the regeneration of θ_1 mesons in the unscattered beam. A simple relation is derived between the intensities of the above process and of the θ_1 mesons regenerated by scattering. Experimental verification of the relation may give additional information about the nature of the neutral K mesons. (auth)

6852

CONSEQUENCES OF CHARGE INDEPENDENCE FOR THE MAGNETIC MOMENTS AND MASSES OF Σ HYPERONS. R. Marshak, S. Okubo, and G. Sudarshan (Univ. of Rochester, N. Y.). Phys. Rev. 106, 599-601(1957) May 1.

In this note certain results are pointed out on the magnetic moments and mass differences of the Σ^+, Σ^0, Σ^- hyperons consequent on the postulate of charge independence for strong interactions. (auth)

6853

NUCLEAR POLARIZATION AND EBB AND FLOW EFFECT IN μ-MESONIC ATOMS. E. Nuding. Z. Naturforsch. 12a, 187-94(1957) Mar. (In German)

MICROWAVES

6854 AECU-3460

Illinois. Univ., Urbana. Electrical Engineering Research Lab.

RESEARCH AND INVESTIGATION LEADING TO METHODS OF GENERATING AND DETECTING RADIATION IN THE 100 TO 1000 MICRON WAVELENGTH RANGE OF THE SPECTRUM. Technical Progress Report No. 4 [for] December 1, 1956 to March 1, 1957. P. D. Coleman, M. D. Sirkis, R. Becker, R. Kenyon, R. H. Pantell, H. Spuhler, and A. W. Swago. Mar. 15, 1957. 62p. Contract AT(11-1)-392. $10.80(ph OTS); $3.90(mf OTS).

Development of the rebatron was continued. Diagrams of 20- and 40-kv electron injection schemes are included. Problems in the design of a rebatron for operation above 3 kmc/s are discussed. The design of the dielectrically loaded harmodotron is discussed in detail. Other beam coupling devices are also described. The theory of their operation is summarized. (B.J.H.)

MOLECULAR PROPERTIES

6855 NP-6265

Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.

QUARTERLY PROGRESS REPORT NO. 24. Apr. 15, 1957. 35p. Contract N5ori-07856.

The electronic wave functions of the HF molecule were recalculated. Results are tabulated and graphed. Inaccuracies in previous molecular calculations for LiH were found and corrected. The configuration calculation on the ground state of the hydrogen molecule was completed and summarized. Calculations treating lattice vibrations from an atomistic viewpoint were made on alkali halide crystals. Results are tabulated and graphed. Discussions on the augmented plane wave method for studying iron and a study of hyperfine structure in Mn^{2+} are included. (For preceding period see NP-6207.) (M.H.R.)

NEUTRONS

6856 AECU-3387

Westinghouse Electric Corp. Research Labs., [East] Pittsburgh, Penna.

COMPILATION OF TECHNICAL REPORTS ON THE SUBJECT OF FAST NEUTRON SCATTERING. PART I. [1955]. 163p. Project NR-024-028. Sponsored by ONR and AEC under Contract N6-ORL-156, Task 2. $25.80 (ph OTS); $7.80(mf OTS).

Part II issued as AECU-3402.

Fifteen papers on fast-neutron scattering are included. Three of these papers are on the measurement of the neutron spectrum from inelastic neutron-scattering, four on measurements of energies of de-excitation gamma rays from inelastic scattering, one on the electron transit time in commercial photomultipliers, and seven on theory. (M.H.R.)

6857

THE ANALYSIS OF NEUTRON SPECTROMETER RESONANCE DATA. J. E. Lynn and E. R. Rae (Atomic Energy Research Establishment, Harwell, Didcot, Berks). J. Nuclear Energy 1, 418-44(1957) Apr.

Methods of analysis of the data obtained with slow-neutron spectrometers are described. The data are obtained from transmission, scattering, capture, and fission measurements. It is shown how relationships between the resonance parameters are obtained, and how these relationships are combined to give values of the individual parameters. Detailed mathematical treatment, where necessary, is given in a series of appendices. (auth)

6858

ATTENUATION OF 14.1-Mev NEUTRONS IN WATER. R. S. Caswell, R. F. Gabbard, D. W. Padgett, and W. P. Doering (National Bureau of Standards, Washington). Nuclear Sci. and Eng. 2, 143-59(1957) Apr.

The attenuation of 14.1-Mev neutrons in water has been studied under conditions simulating an isotropic point source of monoenergetic neutrons in an infinite water medium. The migration area of thermal neutrons ($\langle r^2 \rangle th/6$) was found to be 156 ± 6 cm^2. The "age" of indium resonance neutrons was measured to be 150 ± 6

cm^2. Fast neutron dose measurements are in agreement with the theoretical calculations of Goldstein et al. (auth)

6859

SPATIAL DISTRIBUTION OF THERMAL NEUTRONS FROM AN N^{17} SOURCE IN WATER. Kalman Shure and Paul A. Roys (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 2, 170-80(1957) Apr.

The thermal neutron flux in a water medium from a source disk containing water irradiated in the Materials Testing Reactor has been measured using a BF_3 detector. Neutrons from N^{17} and photoneutrons from N^{16} gamma rays have been observed. The radial distribution of thermal neutrons from an isotropic point source of N^{17} neutrons in a water medium out to 35 cm has been deduced, and has been compared with a theoretical calculation of the distribution based on Holte's values of the collision density at 1 ev from a point isotropic source of 1-Mev neutrons. From the results of this experiment and Holte's distribution, the square of the diffusion length plus the age from 1 ev to thermal energies, has been calculated to be 8.2 cm^2. This value is in reasonable agreement with previously reported measured values. (auth)

6860

NEUTRON THERMALIZATION. II. HEAVY CRYSTALLINE MODERATOR. Mark Nelkin (Knolls Atomic Power Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 2, 199-212(1957) Apr.

The energy distribution of neutrons thermalized in an infinite homogeneous medium containing a crystalline moderator and absorbing material is investigated with the aid of a simplified model of the crystal. A Debye phonon spectrum is assumed, and a formal expansion in powers of the ratio of neutron mass to moderator atom mass is used. The inelastic scattering is approximated by the term of first order in the mass ratio, and interference effects are neglected. The resulting energy-change kernel is not correct in detail at high energies, but it correctly gives the average logarithmic energy loss, and therefore can be used in the age theory approximation at energies well above thermal. Solutions of the integral equation for the energy spectrum have been obtained on the IBM-650 for (1/v) absorption. These are compared to solutions of the differential equation for a heavy gaseous moderator. It is found that the thermal spectra are very insensitive to the choice of scattering model, even when large departures from thermal equilibrium occur. (auth)

6861

THE MODAL NON-ESCAPE PROBABILITY OF NEUTRONS FOR CONVEX BODIES. G. W. Anthony (Hanford Atomic Products Operation, Richland, Wash.). Nuclear Sci. and Eng. 2, 220-4(1957) Apr.

Equations are developed for the modal nonescape probability of neutrons for convex bodies. Calculations of collision probability and capture fraction are shown in graphical form. (B.J.H.)

6862

THERMAL INELASTIC SCATTERING OF COLD NEUTRONS IN POLYCRYSTALLINE GRAPHITE. L. S. Kothari and K. S. Singwi (Atomic Energy Establishment, Bombay, India). Phys. Rev. 106, 230-4(1957) Apr. 15.

The temperature variation of the thermal inelastic scattering cross section of cold neutrons in graphite, calculated on the assumption of a Debye frequency spectrum, is in disagreement with experiments. This is not surprising in view of the highly anisotropic nature of its lattice. Formulas of the scattering cross section were modified for the case of an anisotropic layer lattice. Using the Krumhansl and Brooks model of graphite with the values of the parameters occurring in their theory as fixed by Keesom and Pearlman on the basis of their specific heat measurements at low temperatures, the inelastic scattering cross section for 10 A neutrons was calculated as a function of temperature. The calculated values are in reasonably good agreement with the experimental results of the Brookhaven group. For room temperature the variation of the scattering cross section with neutron wavelength was also calculated and it was found to be in disagreement with the observed variation. This discrepancy may be partly due to small-angle scattering arising from the finite grain size of carbon. (auth)

NUCLEAR PHYSICS

6863 ANL-5667

Argonne National Lab., Lemont, Ill.

PHYSICS DIVISION SUMMARY REPORT [FOR] SEPTEMBER THROUGH DECEMBER 1956. Feb. 1957. 107p. Contract W-31-109-eng-38. $0.50(OTS).

Progress is reported on the development of neutron detectors. The 16-in. long, B-loaded, liquid scintillation detector was tested and proven satisfactory. Fission cross-section measurements on Pu^{239} were continued. The installation and operation of the Van de Graaff generator are reviewed. A study was made of the angular distribution of the γ rays in the $Li^7(\alpha,\gamma\gamma)B^{11}$ reaction. Data are given in both graphical and tubular form, and an energy level diagram for the reaction is included. The study of the reaction $Mn^{55}(p,n)Fe^{55}$ was also continued. The decay properties of 9-hr Eu^{152} are given. A study was also made of the γ rays from the thermal-neutron induced fission of U^{235}. The results of the study are shown in graphical form. The Doppler-shift technique was used to obtain additional information relating to the lifetime of the first excited state of Na^{23} at 440 kev. A value of 2.0×10^{-12} sec was found for the lifetime. A determination was also made of the energy of the delayed neutrons from 15.5-sec fission product Br^{88}. The 7.7-meter bent crystal spectrometer was used for further studies of the γ rays emitted by a Au source. Data are included on the K x rays from Au and Hg and on the decay scheme of Hg^{198}. Values of the differential neutron elastic scattering cross section of Pb for 14-Mev neutrons were measured with an angular resolution of ±3.5 degrees. The neutron transmission cross section of Al was measured from 1 to 140 kev. Methods for the analysis of s-wave neutron scattering resonance are discussed. The level spacings of Cr^{52} and Fe^{56} are tabulated. Experiments for the study of characteristics of photomultiplier tubes are outlined. Work on scintillation detectors is also reviewed. The fluorescence spectra of some plastic scintillators excited by ultraviolet light were determined, and a summary of of the results is tabulated. The behavior of the current from a specimen of Plexiglas was studied as a function of the temperature. The features of the dynamic condenser magnetometer are discussed in detail. Radiation damage studies on Plexiglas were continued. Work in mass spectroscopy is reviewed. The yield of Be ions from a solid target under bombardment of gaseous ions was redetermined as a function of the mass of the bombarding ions. Complete results are given. Work in theoretical nuclear physics is also briefly reviewed. (For preceding period see ANL-5609.) (B.J.H.)

6864 NP-6264

Pittsburgh. Univ. Sarah Mellon Scaife Radiation Lab.

STUDIES OF THE ANNIHILATION OF POSITRONS IN GASES. Final Report [for] December 1, 1955 through November 30, 1956 [on] RESEARCH AND DEVELOPMENT ON STUDY OF POSITRONIUM AND MAGNETIC MOMENT

OF THE ELECTRON. Milton Heinberg and Lorne A. Page. 70p. DA Project No. 5B99-01-004. Contract DA-36-ORD-515.

Studies were made of the angular correlation of the two quantum annihilation of positrons in O, A, and SF_6 and mixtures of N_2O and A, NO and A, and O_2 and A. Results are presented graphically. The quenching of positronium annihilation by a magnetic field was also studied. Data are presented for A, A and O, N_2O, SF_6, N, N_2 and A, NO in A, and O_2 and A. The effect of the application of an electric field to A in which free positrons exist on the number of positronium atoms formed was studied. Some evidence of the n = 2 states of positronium was found. (B.J.H.)

6865 NP-6283

Naval Research Lab., Washington, D. C.

NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. Progress Report for the Period January–March 1957. Apr. 1, 1957. 27p.

Studies were made of the γ-ray spectra resulting from the Coulomb excitation of Cs^{133} and isotopically enriched Ba^{135} and Ba^{137}. The differential cross section for the $C^{13}(He^3,\alpha)C^{12}$ reaction at 2.0 Mev is given. Angular distribution of the α particles from the $C^{13}(He^3,\alpha)C^{12}$ reaction at 4.5 Mev are also given. A study was also made of K-meson stars in emulsion. Data on decaying hyperons in these stars are summarized. The photoneutron reactions in F^{19} and N^{14} were studied near threshold. Activation curves for the reactions are included. The half life of F^{18} was found to be 1.82 ± 0.02 hrs. Measurements were also made on the photoneutrons from lead. The gamma spectrum of Rb^{84m} was also measured. (For preceding period see NP-6197.) (B.J.H.)

6866 NP-6294

Bartol Research Foundation, Philadelphia.

SIXTH ANNUAL REPORT OF THE WORK OF THE BARTOL RESEARCH FOUNDATION OF THE FRANKLIN INSTITUTE. C. E. Mandeville. Sept. 30, 1956. Includes nine reprints. 266p. Contract N6ori-144.

Resonance fluorescence studies are reviewed. A detailed study was made of the radiations from W^{185} and W^{187} Beta and γ spectra for the isotopes are shown. Data are tabulated on the intensities of γ rays from W^{185} and on the conversion lines of the γ rays of W^{187}. Suggested decay schemes are included. Measurements were also made on the γ-ray spectrum of As^{77}. A decay scheme is also given for As^{77}. The search for a long-lived radioisotope of Nd is described. Resonance fluorescence techniques were used to measure the lifetimes of the 6.91- and 7.12-Mev excited states of O^{16}. Mean lives of 1.2×10^{-14} sec and 7.7×10^{-15} sec were found for the 6.91- and 7.12-Mev states, respectively. These techniques were also used to study the lifetime of the 4.43-Mev state of C^{12}. The lifetime was found to be $>5 \times 10^{-14}$ sec. Theoretical studies of the mass-energy relation in quantum theory are reviewed. General descriptions are given of a shipboard cosmic-ray observatory. Texts are included of work which has or will be published. (For preceding period see NP-5910.) (B.J.H.)

6867 UCRL-2426(Rev.)

California. Univ., Berkeley. Radiation Lab.

HIGH-ENERGY PARTICLE DATA. VOLUME I. Beverly Hill Willis and Charles V. Stableford. Nov. 1956. 87p. Contract W-7405-eng-48. $0.50(OTS).

Data in the form of graphs on the kinematics of elementary particles and the dynamics of proton collisions are given. The lower kinetic-energy limit is 100 kev for all particles except electrons, for which the lower limit is 1 kev. The upper energy limit corresponds in all cases to a gamma ray of between 20 and 100. Kinetic energy functions are included for electrons, mesons (μ^+, π^0, π^+, and K^+), hyperons (Λ^0, Σ av, Ξ^-), protons, deuterons, and alpha particles. Proton collision data for photons, electrons, π and K mesons, and protons are graphed. A set of master sheets is included as an aid to those who wish to construct similar graphs for other particles. (M.H.R.)

6868 UCRL-3689

California. Univ., Berkeley. Radiation Lab.

PHYSICS DIVISION QUARTERLY REPORT [FOR] NOVEMBER, DECEMBER 1956, JANUARY 1957. Feb. 26, 1957. 49p. Contract W-7405-eng-48. $0.35(OTS).

Bubble chamber research is reviewed. Lifetimes are reported for τ, $K_{\pi 2}$, and $K_{\mu 2}$ mesons. Experiments on K^- interactions in H and on catalysis of nuclear reactions by μ^- mesons are briefly reported. An analysis was made of the interaction and decay of K^- mesons and their reaction products. Work in theoretical physics is reviewed. Designs are given for an antiproton-selecting spectrograph. The apparatus for measuring antiproton annihilation cross sections is also described. Provisional values of cross sections for some elements are included. An apparatus is also shown for detecting antineutrons produced by charge exchange of antiprotons in a Cherenkov counter. Designs are included for a wide-range β–γ dose rate meter. (For preceding period see UCRL-3593.) (B.J.H.)

6869 UCRL-3702

California. Univ., Berkeley. Radiation Lab.

THE APPLICATION OF CHARGE INDEPENDENCE TO STRANGE-PARTICLE REACTIONS. Tsuneyuki Kotani. Mar. 1, 1957. 26p. Contract W-7405-eng-48. $0.25(OTS).

Some restrictions can be derived from the application of the charge-independence hypothesis to the strange-particle reactions. Some graphs are shown by which the contributions from various isotopic spin states can be easily compared. For K^- capture by a proton, the contribution from the T = 0 state must be a little larger than that from the T = 1 state. For K^+ scattering by a nucleon, no definite conclusion can be stated from the experiment discussed here. The possibilities of determining the fraction α of the Λ° hyperon that undergoes normal charged decay also are discussed. Further, a selection rule ($\Delta T = 1/2$) for the weak interaction is discussed. (auth)

6870 AEC-tr-2875

COULOMB PHASES AND AMPLITUDES TAKING INTO ACCOUNT THE FINITE NUCLEAR SIZE. L. A. Sliv and B. A. Volchok. Translated by Rose V. Jermain from a Publication of the Academy of Sciences, U.S.S.R., 1956. (Moscow–Leningrad). 24p.

6871

BREMSSTRAHLUNG OF NEUTRAL VECTOR PARTICLE WITH ANOMALOUS MAGNETIC MOMENT. Kurt Baumann. Acta Phys. Austriaca 11, No. 1, 59-69(1957). (In German)

6872

REDUCED STRIPPING WIDTH AND SHELL MODEL. O. Hittmair. Acta Phys. Austriaca 11, No. 1, 70-5(1957). (In German)

6873

K-CAPTURE WITH TWO PHOTONS. Walther Menhardt. Acta Phys. Austriaca 11, No. 1, 101-6(1957). (In German)

6874

MESONS AND THE STRUCTURE OF NUCLEONS. Bernard T. Feld (Massachusetts Inst. of Tech., Cambridge). Ann. Phys. 1, 58-76(1957) Apr.

An atomic model of the physical nucleons is considered in which the structure is represented as a nucleon core surrounded by a pion cloud in a $p_{\frac{1}{2}}$ state, the system being

in a state of isotopic spin ½. From the pion wave function, constructed on this basis, the static properties of the physical nucleons—magnetic moments, charge distributions, mass difference—are derived and compared with observation. Modifications are considered which could bring the predictions of this model into better accord with the experiments. It is shown that the core must be given properties, both of size and of structure, which deviate considerably from those of the Dirac nucleons. Some discussion is given of the relationships of the atomic model to meson field theories. (auth)

NUCLEAR PROPERTIES

6875

ISOTOPIC EFFECT IN THE CAPTURE OF NEUTRONS (Br^{80} AND Br^{82}). D. Apers, P. Capron, and L. Gilly. J. chim. phys. 54, 314-16(1957) Apr. (In French)

Experiments made with iso C_3H_7Br, purified by passage through an alumina column and irradiated with slow neutrons, show a different chemical behavior of bromine isotopes 80 and 82. This difference is shown in the activity ratios of two isotopes in the liquid either passed or not passed through an alumina column. These results confirm previous results on isomerism. (tr-auth)

6876

ELASTIC SCATTERING OF 40-Mev PROTONS BY He^4. Morton K. Brussel and John H. Williams (Univ. of Minnesota, Minneapolis). Phys. Rev. 106, 286-9(1957) Apr. 15.

Monoenergetic 39.8-Mev protons, accelerated by the Minnesota linear accelerator, were scattered by purified helium gas. The elastically scattered protons were detected at forty three angles between 4° and 135° and the results are presented in terms of the absolute differential scattering cross section per unit solid angle in the center-of-mass system of coordinates. Definite minima and maxima in the variation of cross section with angle were observed. (auth)

6877

ENERGY LEVELS OF Pb^{204}. M. J. Kearsley (Univ. of Manchester, Eng.). Phys. Rev. 106, 389(1957) Apr. 15.

A calculation of the excited energy levels of the nucleus Pb^{204} has been made treating it as a system of two neutron holes moving in the presence of the double closed-shell core Pb^{208}. At one point there is agreement between theory and experiment, all of the lowest seven excited states being predicted within 0.1 Mev of the experimental values, with the correct spins and parities. (M.H.R.)

6878

ANGULAR DISTRIBUTION OF GAMMA RAYS FOLLOWING COULOMB EXCITATION IN EVEN-EVEN NUCLEI. F. K. McGowan and P. H. Stelson (Oak Ridge National Lab., Tenn.). Phys. Rev. 106, 552-9(1957) May 1.

The angular distributions of gamma radiation from Coulomb excitation with respect to the incident proton beam on thick targets have been measured in the even-even nuclei Ru^{104}, Pd^{108}, Pd^{110}, Cd^{110}, Cd^{112}, Cd^{114}, Cd^{116}, $Os^{190,192}$, and Pt^{194}. The particle parameters α_ν for a thick target deduced from the measurements on Ru^{104}, Pd^{110}, Cd^{114}, and Pt^{194} agree to within the accuracy of the experiments (±2 to 5% for α_2) with the numerical results from the quantum-mechanical treatment of the Coulomb excitation process. (auth)

6879

PRODUCTION AND PROPERTIES OF THE NUCLIDES FERMIUM-250, 251, AND 252. S. Amiel, A. Chetham-Strode, Jr., G. R. Choppin, A. Ghiorso, B. G. Harvey, L. W. Holm, and S. G. Thompson (Univ. of California, Berkeley). Phys. Rev. 106, 553-4(1957) May 1.

The nuclides Fm^{250}, Fm^{251}, and Fm^{252} were produced by alpha bombardment of Cf^{249}. The excitation functions for their formation, as well as some of their nuclear properties, were measured. (auth)

6880

PHOTOFISSION CROSS SECTIONS OF U^{235}, U^{238}, Th^{232}, Bi^{209}, AND Au^{197} AT ENERGIES OF 150 TO 500 Mev. John A. Jungerman (Univ. of California, Davis and Berkeley) and Herbert M. Steiner (Univ. of California, Berkeley). Phys. Rev. 106, 585-90(1957) May 1.

Photofission cross sections for U^{238}, U^{235}, Th^{232}, Bi^{209}, and Au^{197} have been measured by use of bremsstrahlung spectra whose maximum energies ranged from 150 to 500 Mev. The fissions were detected in 2π geometry with a double ionization chamber. A suggested correlation of the resulting cross sections with those for proton fission and for photomeson production is made. (auth)

6881

NUCLEAR MAGNETIC RESONANCE IN PARAMAGNETIC IRON GROUP FLUORIDES. V. Jaccarino and R. G. Shulman (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. 106, 602-3(1957) May 1.

The shift of the nuclear magnetic resonance of F^{19} in CoF_2 and FeF_2 is shown as a function of temperature. Data are also given on the angular dependence of the resonance. Explanations of the shifts are briefly discussed. (B.J.H.)

6882

NUCLEAR MAGNETIC RESONANCE IN CoF_2 AND FeF_2. J. M. Baker and W. Hayes (Clarendon Lab., Oxford, Eng.). Phys. Rev. 106, 603-4(1957) May 1.

Measurements were made of the paramagnetic shift of the field in which nuclear magnetic resonance of F^{19} occurs in CoF_2 and FeF_2. Observed values of the shift parameters are tabulated and compared to calculated values. (B.J.H.)

NUCLEAR REACTORS

6883 AERE-Inf/Bib-106

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

LIQUID METAL FUELLED REACTORS. A BIBLIOGRAPHY OF PUBLISHED AND UNCLASSIFIED REPORT LITERATURE. G. L. Cooper and A. Potter. Oct. 1956. 27p.

6884 ANL-5685

Argonne National Lab., Lemont, Ill.

20-MW D_2O-MODERATED EXPERIMENTAL BOILING WATER REACTOR DESIGN STUDIES. H. P. Iskenderian. Feb. 1957. 32p. Contract W-31-109-eng-38. $0.25(OTS).

Criticality and reactivity calculations have been made for some specific lattice designs for use in the present EBWR reactor vessel. D_2O has been considered as a coolant-moderator. More specifically, critical enrichments, temperature coefficients, the effects of small amounts of H_2O in the D_2O, and the effects of power excursions on reactivity have been studied. The accuracy of these calculations is limited by that of the method of the two-group diffusion theory and the four-factor formula. The value of the constant η used in the four-factor formula refers to thermal energies and does not allow for the increased value of α of U^{235} at resonance energy levels. This has resulted in a lower critical enrichment than required. This should not affect appreciably, however, the accuracy of the various reactor characteristics such as temperature coefficient of reactivity, effects of H_2O additions in the moderator on reactivity, and power excursions. (auth)

6885 APAE-Memo-2a

Alco Products, Inc., Schenectady, N. Y.

INTERPRETATION OF EXPERIMENTAL FLUX AND POWER DATA ON THE APPR-1 CRITICAL EXPERIMENT. P. V. Oby and J. G. Gallagher. Dec. 23, 1955. Decl. Apr. 30, 1957. 15p. $3.30(ph OTS); $2.40(mf OTS).

6886 APAE-Memo-85

Advanced Scientific Techniques Research Associates, Milford, Conn.

THE EFFECT OF GAMMA HEATING ON THE APPR-1 PRESSURE SHELL. H. R. Kroeger, I. M. Neou, and J. L. Meem. Sept. 1956. 222p. For [Alco Products, Inc. Contract AT(11-1)-318]. (ASTRA-415-E-2.1). $1.00(OTS).

Thermal stresses in the APPR-1 pressure shell due to radiation induced heating were calculated to be of the order of 2640 psi. The origin and characteristics of the neutron and gamma radiations which produce this heating are considered. Extensive instrumentation of the APPR-1 is recommended to establish the accuracy of the calculations. (D.E.B.)

6887 APDA-108

[Atomic Power Development Associates, Inc., Detroit]. DESCRIPTION OF DEVELOPMENTAL FAST NEUTRON BREEDER POWER REACTOR PLANT. Sept. 1, 1955. 104p. $0.55(OTS).

The general characteristics of Na-cooled fast reactors are briefly reviewed. A complete description is given of the proposed APDA fast breeder reactor, including a tabulation of pertinent technical data and descriptions of the core and blanket subassemblies, the reactor compartment, mechanical handling systems, the reactor control system, the liquid metal and steam-power systems, and the disassembly and shipping facility. Site considerations are also discussed in detail. The physical characteristics, geology, seismology, and population distribution of the reactor plant is also considered. (B.J.H.)

6888 BNL-77

Brookhaven National Lab., Upton, N. Y.

A REVIEW OF GRAPHITE TESTING PROCEDURES AND THEIR APPLICATIONS TO THE BNL REACTOR. J. Chernick and I. Kaplan. Nov. 15, 1950. Decl. Dec. 14, 1955. 32p. $0.20(OTS).

The results of various functional tests of the graphite assigned to the BNL Reactor are collected and reviewed. Methods of improving the precision and accuracy of sigma pile tests are discussed. In particular, a simple method is suggested to account for the nonthermal character of the neutron sources presently in use. The alternative use of a cadmium sheet, interposed between the source and detectors for this purpose, is investigated. It is found that for the usual experimental arrangement, the necessary harmonic corrections depend on both the source spectrum and the position of the cadmium sheet. However, by modifying the experimental arrangement to a spherically symmetrical geometry, these difficulties may be avoided. The conventional solution of the sigma pile equations is inappropriate for a sigma pile of large dimensions. An alternate method is developed for the analysis of experiments on the stacked moderator of a reactor. The neutron flux distribution resulting from a source with a continuous neutron spectrum is considered. The basic case of a point source in an infinite medium is treated. Epithermal and thermal flux distributions are obtained for a Po–Be source on the basis of recent experimental data on the source spectrum. The distributions are compared with those resulting from monoenergetic sources. (auth)

6889 BRL-1011

Ballistic Research Labs., Aberdeen Proving Ground, Md.

BLAST EFFECTS TESTS OF A ONE-QUARTER SCALE MODEL OF THE AIR FORCE NUCLEAR ENGINEERING TEST REACTOR. Wilfred E. Baker and James D. Patterson, II. Mar. 1957. 194p. DA Project No. 5B03-04-002.

This report presents the results of a series of ten simulated nuclear power excursions conducted within a one-quarter scale model of the Air Force Nuclear Engineering Test Reactor. The objective of the tests was to simulate, as closely as possible, large nuclear power excursions of the potential predicted by the "Borax" test data and to experimentally evaluate the effects of the resulting blasts on the reactor structure and safety shell. Explosives and propellants were used to simulate the power excursions. Measurements were made of the time histories of pressures, strains, displacements and accelerations at various locations within the model. It is concluded that the reactor design will, with minor modifications, safely contain an explosively-released energy of 1000 megawatt-seconds. This is approximately three times the maximum energy release in the maximum credible power excursion for the AF NETF reactor. The accuracy of simulation of an excursion by explosives and propellants and the applicability and limitations of scaling of blast loading and structural response are discussed. (auth)

6890 CEI-79

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

A PRELIMINARY COST ESTIMATE FOR FUEL RECYCLING. H. K. Rae, D. H. Charlesworth, A. R. Bancroft, F. G. Crouch, G. E. Haddeland, E. Mizzan, A. J. Mooradian, and E. E. Winter. Oct. 1955. 239p. (AECL-418). $3.50(OTS).

A fuel cycle consisting of storage, disassembly, chemical desheathing, dissolving, TBP extraction, denitration, reduction to oxide or metal, fuel-element fabrication and waste disposal for both U and Pu fuels has been studied. Processing costs are estimated in dollars per pound of U, dollars per gram of Pu, and cents per gram of fission products. The total recycling costs for a DR-37 type of fuel cycle are calculated. On the ten-reactor scale (100 electrical Mw per reactor) with two Pu recycles and using UO_2 and Pu–Al alloy as fuels, the cost of fuel recycling is 1.5 mills per kw-hr. This includes the cost of fabricating natural-uranium fuel elements, but not the cost of this U feed which is assumed to enter the cycle as the trioxide. The minimum recycling cost is approached only at the ten-reactor scale of operation. Low costs can only be achieved in processing facilities of a capacity of 1200 pounds of U and 4 kilograms of Pu per day or greater. Fuel-element fabrication contributes more than half the total cost of fuel recycling. This includes 0.5 mills per kw-hr for zircalloy at an assumed price of $30 per pound and 0.2 mills per kw-hr for rod ends at an assumed price of $150 per rod. The quantity of zircalloy sheathing required could be reduced by lowering the fuel rating (power per unit weight of fuel) or increasing the total irradiation. (auth)

6891 CF-55-8-145

Oak Ridge National Lab., Tenn.

SHIELDING FOR THE HRT CHARCOAL PIT AND GAS LINE. T. W. Leland. Aug. 24, 1955. Changed from OFFICIAL USE ONLY May 1, 1957. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Calculations were made of the shielding requirements for the HRT charcoal pit on the basis of a maximum reactor power of 10 Mw. Shielding is provided by 1-ft thick concrete walls and top surrounding the pit plus dirt to be piled on top. It is estimated that the thickness of dirt

required to reduce the radiation intensity at the outer surface to less than 4 mr/hr is 3½ ft. (B.J.H.)

6892 CF-55-10-118
Oak Ridge National Lab., Tenn.
EFFECT OF NON-UNIFORM NEUTRON FLUX DISTRIBUTION ON THE TEMPERATURE DISTRIBUTION IN THICK FUEL ELEMENTS. L. G. Alexander. Oct. 27, 1955. 8p. $1.80(ph OTS); $1.80(mf OTS).

6893 CRR-578(Rev.)
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
HANDBOOK OF SHIELDING AND HEAT PRODUCTION CALCULATIONS FOR THE N.R.U. REACTOR. W. J. Henderson and A. C. Whittier. Jan. 1955. Reprinted Mar. 1957. 507p. (AECL-403). $6.00(AECL).

The shielding and heat production calculations for the NRU Reactor are summarized. In particular, calculations are included on the thermal flux in the reactor, heat production in top and bottom thermal shields, design features of the bulk shield, activities produced in the heavy water, shielding requirements of the main heavy water circuit, gas cooling and ventilation problems, the NRU helium circuit and shielding of the gas purification area, the thermal column, the fuel rod shielding flask, horizontal experimental holes, heat production after reactor shutdown, heat production and activity of the control rods, shielding of the pneumatic capsule lines, and heavy water leaks in the heat exchanger. Appendices are included on γ and neutron absorption in various materials. (B.J.H.)

6894 DM-42
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
FUELLING SYSTEM FOR NATURAL URANIUM REACTOR WITH LONG RODS FOR HIGH BURN-UP WITHOUT RECYCLING. W. B. Lewis. Mar. 29, 1957. 18p. (AECL-436).

Since natural uranium as a reactor fuel becomes progressively poisoned and the effect of the poison is approximately proportional to $(\text{neutron flux})^2$, it is advantageous to irradiate fuel first in a region of high flux and then move it to a position of lower flux. Schedules based on this principle are examined in detail with application to NPD, the Canadian Nuclear Power Demonstration reactor. This is a heavy water moderated reactor, fuelled by a lattice of 109 rod assemblies of natural uranium in the form of UO_2. It is shown that on the basis of the best data available if it is possible to operate at a mean reactivity level about 12.5 milli-k below that of a fresh fuel charge in equilibrium with full xenon and samarium poisons, it should be possible to attain an average energy yield of 4,000 Mwd/ton of uranium. An improved fuelling schedule described should increase this further by 300 Mwd/ton. Moreover, if more reactivity proves to be available, the irradiation can be extended by about 85 Mwd/ton per milli-k. The method of analysis is similar to that applied in an earlier report, DR-21 (1952), but more recent nuclear data indicate an energy yield higher than then predicted although still not quite as high as found by experiments on long irradiation of natural uranium in NRX. This and other points noted give a fair measure of confidence in the predictions. The importance of long burn-up on fuelling costs is discussed and it is noted that it should be possible to realize a saving of 2% per milli-k of extra reactivity that may be made available. If the fuelling cost stands at the high figure of $700,000/yr. currently estimated (i.e. 5 mill/kWh), this amounts to an annual saving of $14,000 per milli-k. (auth)

6895 IDO-16332
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
THE ENGINEERING TEST REACTOR CRITICAL FACILITY HAZARDS SUMMARY REPORT. D. R. deBoisblanc, E. E. Burdick, T. K. DeBoer, W. J. Byron, B. L. Hanson, K. A. McCollom, and C. W. Reich. Mar. 27, 1957. 94p. Contract AT(10-1)-205. $0.50(OTS).

The Engineering Test Reactor Critical Facility is a full scale mockup of the core and reflector of the Engineering Test Reactor. Its purpose is to permit reactor physics measurements and engineering measurements to be made which will assist in the design of experiments for, and the operation of, the Engineering Test Reactor. A summary is presented of the hazards attendent to the design and expected modes of operation of the Facility. Sufficient supporting information in the form of detailed appendices has been included to make possible, with a minimum of references to other documents, an evaluation of the basis on which this operation can be justified. (auth)

6896 KAPL-M-ALM-3
Knolls Atomic Power Lab., Schenectady, N. Y.
INITIAL LOADING OF ACME I. A. L. MacKinney and J. S. Franke. [Jan. 1957]. 17p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The initial loading of a critical assembly composed of aluminum, polystyrene, and fuel is described. Plots of the approach to criticality are given. (D.E.B.)

6897 KAPL-M-EDL-123
Knolls Atomic Power Lab., Schenectady, N. Y.
OPERATION OF S2G 8" STOP VALVES FOLLOWING PRIMARY BELLOWS FAILURE. PHASE I—S2G FREEZE SEAL TESTER. P. K. Salzman and F. N. Schell. Feb. 5, 1957. 20p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

Temperature gradients along the secondary bellows of the S2G 8-inch Stop Valve were investigated using data obtained from a specially fabricated valve freeze seal test unit. Included in the system conditions studied were the source and ambient temperatures, the coolant water temperatures, and the coolant flow rate. (auth)

6898 NAA-SR-Memo-1116
North American Aviation, Inc., [Downey, Calif.]
USE OF THE SRE FUEL IN AN EXPONENTIAL EXPERIMENT. R. A. Laubenstein. Oct. 5, 1954. Decl. Feb. 28, 1957. 10p. $0.15(OTS).

A brief description is given of an exponential experiment for investigating nuclear parameters of proposed lattices for Na-graphite reactors. The safety precautions to be followed in performing the exponential experiments with U fuel ordered for the SRE are discussed. Calculations indicate that it is extremely unlikely that the proposed exponential assembly will become critical. By following the safety precautions described, it is believed that the possibility of a criticality accident with the experiment will be reduced to a negligible value. (auth)

6899 NP-6268
Max-Planck-Institut für Physik, Göttingen.
ZUR THEORIE DER REAKTOREN MIT SCHNELLEN NEUTRONEN. (The Theory of Reactors With Fast Neutrons.) [Report] No. 1. R. Schulten. [1954?]. 9p.

6900 NP-6269
Max-Planck-Institut für Physik, Göttingen.
BESTIMMUNG DES NEUTRONENFLUSSES IN EINEM THERMISCHEN REAKTOR. (Determination of Neutron Flux in a Thermal Reactor.) [Report] No. 2. R. Schulten. [1954?]. 10p.

6901 NP-6270
Max-Planck-Institut für Physik, Göttingen.
TEMPERATURVERLAUF IM INNEREN DER URANSTÄBE HEI STATIONÄREM BETRIEB. (Temperature Distribution in the Interior of U Rods in Stationary Operation.) [Report] No. 3. H. Gaus. [1954?]. 4p.

6902 NP-6271
Max-Planck-Institut für Physik, Göttingen.
ZUM VERHALTEN DES PROMPT-UBERKRITISCHEN REAKTORS. (On the State of Prompt Over-Critical Reactors). [Report] No. 4. E. Roxin and R. Schulten. [1954?]. 6p.

6903 NP-6272
Max-Planck-Institut für Physik, Göttingen.
p- UND f- FAKTOREN FÜR IN ALUMINIUM EINGEFASSTE, MIT SCHWEREM WASSER GEKÜHLTE BRENNSTOFF-ELEMENTE IN EINEM SCHWERWASSERREAKTOR. (p- and f- Factors in Al Clad, Heavy Water Cooled Fuel Element in a Heavy Water Reactor.) [Report] No. 5. W. Häfele, K. Meetz, and R. Schulten. Feb. 15, 1956. 11p.

6904 NP-6275
Max-Planck-Institut für Physik, Göttingen.
ÜBER DIE WIRKSAMKEIT VON ABSCHALTSTABEN THERMISCHER REAKTOREN IM HINBLICK AUF DEREN DURCHMESSER, ANZAHL UND ANORDNUNG. (On the Effectiveness of Disconnected Rods of Thermal Reactors in View of their Diameter, Number, and Arrangement.) [Report] No. 8. W. Häfele. June 28, 1956. 39p.

6905 NP-6277
Brussels. Centre D'Etudes Pour Les Applications de l'Energie Nucleaire.
SIMULATEUR DE REACTEUR NUCLEAIRE. (Nuclear Reactor Simulator.) E. Gourski. Dec. 28, 1955. 28p. (B-2).

The reactor simulator described is an electronic apparatus imitating the behavior of thermal reactors. The calculations and construction are explained briefly. The detailed scheme of the simulator and its amplifier is given. A study is made of how to take account of the delayed elements, the source term, and control of the reactivity. The simulator gives information on the behavior of phenomena such as transients and the stable period. Graphs show the results of these studies. (tr-auth)

6906 NP-6278
Brussels. Centre D'Etudes Pour Les Applications de l'Energie Nucleaire.
ETUDE D'UN SYSTEME URANIUM ENRICHI–GRAPHITE REFROIDI PAR AIR. (Study of an Enriched Uranium–Graphite System Cooled by Air). H. Dopchie. Apr. 13, 1956. 9p. (B-3).

A study was made of the introduction of elements containing 20% enriched U in the BR-I reactor. These elements are formed by three curved Al plates containing the enriched U and joined to each other by Al rings. They are similar to the elements described in report P/860 of the Geneva Conference entitled "The Brookhaven Reactor" by Marvin Fox. It is shown that if one limits the maximum air speed to 100 m/sec, the exit air temperature to 300°C, and the plate temperature to 350°C, the maximum allowable flux is about 10^{13} n/cm^{2}sec. It is also shown that this allowable flux is practically independent of the amount of U enrichment, above a value of 20% in U^{235}. (tr-auth)

6907 ORNL-2256
Oak Ridge National Lab., Tenn.
AQUEOUS HOMOGENEOUS RESEARCH REACTOR—FEASIBILITY STUDY. P. R. Kasten, M. I. Lundin, C. L. Segaser, R. E. Aven, D. R. Gilfillan, R. F. Hughes, M. C. Lawrence, H. A. McLain, R. A. McNees, C. Michelson, and C. W. Nestor. May 9, 1957. 49p. Contract W-7405-eng-26. $0.35(OTS).

The problems associated with an aqueous homogeneous reactor that would provide high thermal- and fast-neutron fluxes for experimental use are described. The results of a preliminary investigation into the feasibility of an aqueous homogeneous research reactor (HRR) for producing a thermal flux of 5×10^{15} neutrons/cm^2/sec are included. (T.R.H.)

6908 RM-1835(RAND)
RAND Corp., Santa Monica, Calif.
THE CRITICALITY AND SOME POTENTIALITIES OF "CAVITY REACTORS" (Abridged). George Safonov. July 17, 1955. 23p. (AD-112410).

A critical equation is derived for reacting systems with cores of very low density thermally fissionable material surrounded by a moderating reflector. The critical mass of "cavity reactors" (the designation adapted for such low density core reactors) which employ U^{235}, U^{233} and Pu^{239} for fuel and D_2O, Be and C for reflector is given as a function of core size. It is estimated that a six foot diameter cavity in Be or C requires about 12 to 14 Kg of U^{235} for criticality. The same cavity in D_2O requires about 2 Kg of U^{235}. The critical masses of Pu^{239} and U^{233} are smaller. Possible implications of cavity reactors are briefly discussed. (auth)

6909 WAPD-MRP-66
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PRESSURIZED WATER REACTOR (PWR) PROJECT TECHNICAL PROGRESS REPORT FOR THE PERIOD DECEMBER 24, 1956 TO FEBRUARY 23, 1957. 77p. Contract AT-11-1-GEN-14. $0.45(OTS).

Additional studies were undertaken to establish the degree of reactor and plant safety. Construction progress is reviewed. Performance and corrosion tests on reactor and reactor system components were continued. The status of core component fabrication is given. Developments in core component handling, assembly, and instrumentation planning are reviewed. Fuel rod, blanket plate, and control rod fabrication and inspection experience is summarized. Weld penetration and contamination problems observed following subassembly fabrication were resolved by revisions in fabrication parameters. Basic investigations of metallurgical problems with U-base alloys and fuel cladding alloys were continued. Available information on in-pile tests of UO_2 fuel element sections is given. Further studies were made of the chemical and metallurgical properties of UO_2. Progress in computer coding for flux, reactivity, and life-time calculations is summarized. (For preceding period see WAPD-MRP-65.) (D.E.B.)

6910 WAPD-TM-43
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
DIFFUSION APPROXIMATION FOR HYDROGEN MODERATOR IN THERMAL REGION. W. W. Clendenin. Mar. 4, 1957. 12p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

The effect of motion of the moderator atoms on thermal neutron distribution has been described by Wigner and Wilkins for the case of an infinite medium. These equations were generalized to a slab geometry. (D.E.B.)

6911
NUCLEAR REACTOR START-UP SIMULATION. J. P. Franz and N. F. Simcic (Westinghouse Electric Corp., Pittsburgh). IRE Trans. Nuclear Sci. NS-4, 11-14(1957) Mar.

This paper describes the problem of simulating nuclear reactor start-up with an electronic analog computer. The reactor kinetic equations are discussed and the range that

their solution must cover is defined. Source range simulation and alternate methods of simulating the intermediate range are presented. The use of reactor period signal in the intermediate range is described. In the power range, which includes a representation of the heating and temperature effects, the inherent advantages of a pressurized water reactor are outlined. The portion of the start-up simulation which applied to nuclear reactors in general is summarized. The areas of modification necessary for the simulation of other than pressurized water reactors is outlined. (auth)

6912

FREQUENCY RESPONSE MEASUREMENTS OF POWER REACTOR CHARACTERISTICS. H. Estrada, Jr. (Westinghouse Electric Corp., Pittsburgh). IRE Trans. Nuclear Sci. NS-4, 15-19(1957) Mar.

The problem of measuring fundamental characteristics of an inherently stable power-producing reactor is described. It is noted that, in the power range of operation of such a plant, reactivity is a function not only of control rod position, but also of power itself. The mechanism of the latter effect involves the various inherent coefficients of reactivity. The result is that conventional, low-power methods can be used neither to obtain rod calibrations, nor to determine temperature coefficients in the very range of operation where these characteristics assume importance. It is shown that a number of parameters including those mentioned above may be measured by effecting small sinusoidal perturbations in control rod position over a range of frequencies. The resultant frequency responses are analyzed by the familiar transfer function—block diagram method. Certain inherent advantages of the method are cited. A brief description is included of the manner by which the technique is used to determine various nuclear properties. It is also noted that certain thermal and hydraulic characteristics of the plant can be determined using the method. Further, it is pointed out that the reactor plant frequency responses constitute a quantitative check on the accuracy of the differential equations used in the construction of plant simulators (analog computers), devices which are used extensively in the transient analysis of power reactors. (auth)

6913

THE RELATIVE STABILITY OF BOILING AND PRESSURIZED LIGHT WATER MODERATED REACTORS. John MacPhee (AM. Mach. & Fdry. Co., Greenwich, Conn.). IRE Trans. Nuclear Sci. NS-4, 25-9(1957) Mar.

This paper compares the stability of a given heterogeneous core when operated with a pressurized or subcooled water cooling system in which the power is removed by boiling. In order to provide a basis for comparison the following assumptions are made: 1) reactor power is the same in both cases, 2) the core geometry is the same in both cases, 3) in the case of subcooled operation, coolant flow rate and core inlet temperature are held constant, and 4) in the case of boiling operation reactor pressure is constant. Assumptions 3) and 4) imply that the load equals power generated. The core geometry and the values of the various system parameters are taken from published literature wherever possible. It is shown that the results of this analysis are readily predictable from physical reasoning. (auth)

6914

DESIGNING HETEROGENEOUS REACTORS FOR STABILITY. D. Little and M. A. Schultz (Westinghouse Electric Corp., Pittsburgh). IRE Trans. Nuclear Sci. NS-4, 30-3 (1957) Mar.

An engineering method of examining nonlinear kinetics is capable of giving considerable information over a wide range of variables and is used with suitable approximation to examine the stability of heterogeneous reactors. (M.H.R.)

6915

SOME PROBLEMS IN THE MAINTENANCE OF NUCLEAR REACTORS. H. G. Davey (U.K.A.E.A. Industrial Group, Windscale Works, Sellafield). J. Brit. Nuclear Energy Conf. 1, 173-88(1956) Oct.

When the Windscale reactors were being designed it was assumed that after they went on power the parts subjected to radiation could not be maintained. A fundamental concept of design was to make the reactor itself static and to keep moving parts outside the biological shield. Since the piles were air-cooled, air had to be pulled or pushed through the reactor. Pushing was chosen because the large fans would remain inactive and uncontaminated, and could be given normal maintenance. Over a period of time items contained within the reactor proper and subjected to influence and effect of flux, temperature and air flow developed faults and, therefore, unusual and unexpected maintenance had to be done under reactor conditions. Each problem was novel and special techniques had to be evolved for simple mechanical operations rendered difficult by the circumstances and hazards. The paper gives examples of work done, techniques evolved for doing it, and precautions taken to insure that the personnel engaged were not contaminated and did not receive radiation doses exceeding the limits set by the Medical Research Council. After 5 years' operating experience the author is satisfied that, given certain facilities, and by following techniques now evolved, a reactor can be a maintainable unit. This will have a fundamental effect on future design. (auth)

6916

NUCLEAR REACTORS FOR POWER GENERATION. B. L. Goodlet (Brush Electrical Engineering Co. Ltd, Falcon Works, Loughborough). J. Brit. Nuclear Energy Conf. 1, 189-215(1956) Oct.

The paper is intended as an educative introduction to problems encountered in the design of nuclear reactors for power generation. It is based on 5 years' work in this field. Part I formulates various problems of reactor technology under the headings reactor physics, reactor materials, radiation and radioactivity, and engineering design. In Part II an attempt is made to show how various kinds of reactor—fast, pressurized and boiling-water, and graphite-moderated—arise naturally from application of the elements of reactor theory and reactor technology. Part III deals with the running control of nuclear power plant. The appendix attempts to summarize, in language comprehensible to engineers, the basic physics on which reactor operation depends. (auth)

6917

STEAM CYCLES AND NUCLEAR POWER PLANT. R. E. Zoller (Babcock & Wilcox Ltd., London). J. Brit. Nuclear Energy Conf. 1, 216-26(1956) July.

The use of several reactor core-coolant media is considered, and suitable single and multi-pressure steam cycles for various reactor systems are discussed. Where the coolant-circulating power consumption is appreciable, the selection of the optimum operating condition for certain power reactors is illustrated. Methods of avoiding excessive moisture in the turbine exhaust particularly applicable to water-cooled reactors are suggested and discussed. With reactor power plants limited to low coolant temperatures, the use of separately fired superheaters should be given careful consideration, in view of the high utilization efficiency of the oil fuel and the very low initial capital cost of the resulting additional station capacity. (auth)

6918

HEAT REMOVAL FROM NUCLEAR POWER REACTORS. Jack Diamond (Manchester Univ.) and W. B. Hall

(U.K.A.E.A., Sellafield). J. Brit. Nuclear Energy Conf. 1, 227-40(1956) July.

The general problem is described of heat removal from nuclear-power reactors in which the fuel elements are in the form of solid rods or bars. The energy released in the fuel must be transferred to a coolant by forced convection and, for reasons of power-cycle efficiency, it is desirable that it be transported from the reactor by the coolant at a temperature as close as possible to the maximum permissible fuel temperature. The influence of the coolant physical characteristics and of fuel element extended surfaces on the maximum coolant temperature and on pumping-power losses for a given heat-removal rate are discussed, and gaseous and liquid coolants are compared. Simple methods are suggested for a first analysis of the heat-transfer aspects of a reactor cooling problem and are demonstrated by an example in gas cooling. (auth)

6919

THE REACTIVITY EFFECT DUE TO NEUTRON STREAMING IN AN EMPTY TUBE. E. Critoph and R. M. Pearce (Atomic Energy of Canada Ltd., Chalk River). J. Nuclear Energy 1, 445-59(1957) Apr.

The critical size of a reactor is increased when neutrons can stream along an empty tube passing through the reactor. A perturbation method has been used to calculate the change in reproduction constant required to compensate for streaming in an empty tube parallel to the axis of a right cylindrical reactor. The effect of removing moderator from tubes inserted ZEEP has been measured for tubes with radii in the range 1 to 8 cm. After making minor corrections for effects other than streaming, the experimental results are in satisfactory agreement with the calculations. The reactor constants necessary in making the comparison were obtained from the change in critical size due to a known absorber which was placed at the lattice site in question. (auth)

6920

FAST NEUTRON DAMAGING IN NUCLEAR REACTORS. II. THE RADIATION DAMAGE FUNCTION OF GRAPHITE. W. Primak (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, 117-25(1957) Apr.

The ratio of the damage rates in graphite irradiated in the converter and VT-4 of CP-3 are explained in terms of the different flux spectra which existed in the respective irradiation facilities. This interpretation requires that the statistical quantity of damage resulting from a scattering event involving a neutron of given energy be nearly constant above 10^5 ev, and this in turn implies that the statistical amount of damage produced by a carbon atom of given energy is nearly constant above 10^4 ev and is in agreement with Seitz's theory. Good agreement is found between the rate at which disturbances in the lattice are accumulated and the rate of carbon atom displacement calculated from Seitz's theory, but this is not considered especially significant since the parameters had originally been adjusted to fit experimental data. (auth)

6921

RADIOACTIVE CARRY-OVER FROM BORAX-III AND TEST SYSTEMS. Arthur J. Shor, Henry T. Ward, David Miller, and Walton A. Rodger (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, 126-42(1957) Apr.

Data obtained from three systems are presented and discussed in reference to the problem of radioactive carry-over in boiling reactors. Measurements of droplet carry-over have been made on a small scale laboratory boiling test unit and on a 600-psia loop under high purity water conditions using Cs^{137} tracer. Measurements have also been made on the Borax-III boiling reactor under actual operating conditions. Activation products present in the steam and condensate served as an indication of the radioactive carry-over. Analysis of the decay curves of the samples provided a means of differentiating activities carried as droplets from volatile radioactive carry-over. (auth)

6922

ENGINEERING DATA FOR DIPHENYL COOLED NUCLEAR REACTORS. L. W. Fromm and Kermit Anderson (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, 160-9(1957) Apr.

Recent experiments have indicated that some organic materials such as diphenyl may be sufficiently resistant to radiation damage to perform satisfactorily as coolants for nuclear reactors. These materials offer such advantages as low vapor pressure at high temperatures, lack of induced radioactivity, and low corrosion attack on fuel and structural materials. A collection of data on vapor pressure, density, specific heat, viscosity, thermal conductivity, and heat transfer film coefficient for diphenyl is presented as an aid to the reactor designer. Some experimental data on melting points and viscosities of mixtures of diphenyl with higher polyphenyls are also given. (auth)

6923

THERMAL STRESSES IN CLAD FUEL PLATES. Charles O. Smith (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, 213-18(1957) Apr.

Equations for the thermal stresses developed in clad, flat, fuel plates with either symmetrical or nonsymmetrical temperature distribution are presented. The stresses developed under one set of conditions are calculated and shown as an application of the equations. (auth)

6924

TWO-GROUP ITERATION METHOD FOR ANNULAR CYLINDERS. Charles N. Kelber and Bernard I. Spinrad (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, 219-20(1957) Apr.

A brief description is given of an iterative technique which was developed to study the critical properties of a homogeneous annular region reflected externally and internally. (B.J.H.)

6925

FISSION PRODUCT RECOIL SEPARATION IN SUSPENSION REACTORS. M. E. A. Hermans and Th.v.d. Plas (R.C.N.-K.E.M.A. Reactor Development Group, Arnhem, the Netherlands). Nuclear Sci. and Eng. 2, 224-6(1957) Apr.

The use of fission product recoil separation in slurry reactors is briefly discussed. The discussion is restricted to a slurry of uranium oxide, in water of pH about 7, as measured at room temperature. The use of active charcoal is suggested for the removal of lanthanides from the slurry system. (B.J.H.)

6926

SECOND-GUESSING THE REACTOR DESIGNERS. J. A. Cox (Oak Ridge National Lab., Tenn.). Nucleonics 15, No. 5, 112-13(1957) May.

A reactor operator's comments on the design of reactors are presented. Operating experience with the LITR has led to recommendations as to beam hole design, gas disposal, water purification, component removal, and canal design. (T.R.H.)

6927

LONG-WAVE NEUTRON SPECTRUM OF THE MATERIALS TESTING REACTOR. L. B. Borst and L. G. Miller (Phillips Petroleum Co., Idaho Falls). J. Appl. Phys. 28, 547(1957) May.

The long-wave spectrum of a neutron beam from the Be reflector of the Materials Testing Reactor (MTR) has been

measured from 3 to 10 A by a total reflection technique. The spectrum was found to vary as $\lambda^{-3.9}$. (auth)

6928

SOME CHARACTERISTICS OF REACTOR GAS COOLING SYSTEMS. P. Fortescue (A.E.R.E., Harwell). Nuclear Power 2, 188-92(1957) May.

With gas-cooled reactor fuel cans using circumferential fins or grossly roughened surface, heat transfer work with a given fin material and coolant gas can be generalized by plotting Stanton number against Reynolds number multiplied by the ratio of the thermal conductivity of the gas to that of the metal. For this type of surface a figure of merit in terms of molecular weight and specific heat is obtained. (auth)

6929

REACTOR PHYSICS. 12. James F. Hill (Reactor School, Harwell). Nuclear Power 2, 201-5(1957) May.

Reactor kinetics is first considered without delayed neutrons. Then, the effect of these neutrons on slowing the rate of power rise is demonstrated and this rate shown to be exponential in form. For the case when the period of the reactor is very short, it can be shown that the rise occurs as if there were no delayed neutrons present. For very long reactor periods, a simple relation between the period and the reactivity induced in the reactor is shown. (M.H.R.)

6930

«ZEPHYR»—ZERO ENERGY FAST REACTOR. T. M. Fry (Atomic Energy Research Establishment, Harwell, Eng.). Nuovo cimento (10) 4, Suppl. No. 3, 1324-8(1956).

A general description of the Zephyr is given. Topics given special emphasis are neutron flux, conversion factor, and perturbation measurements. (M.H.R.)

6931

NUCLEAR REACTORS AND RADIATIONS IN INDUSTRY. VOLUME I AND II. J. R. Sellars, W. Kerr, E. F. Barker, W. C. Lukow, A. H. Ohlgren, L. E. Brownell, and J. V. Nehemias. Ann Arbor, University of Michigan, 1955. 458p. $10.50.

Notes from lectures on the subject are presented. Sections, containing several lectures each, are included on basic physics, nuclear engineering measurements, the interaction of radiation and matter, reactor theory, engineering of nuclear reactor systems, and uses of ionizing radiation. (M.H.R.)

NUCLEAR TRANSFORMATION

6932

EMISSION OF α PARTICLES WHOSE ENERGY IS LESS THAN 9 Mev IN DISINTEGRATIONS OF LIGHT AND HEAVY NUCLEI EXCITED BY 1 Bev PROTONS. Georges Philbert. J. phys. radium 18, 75-6(1957) Jan. (In French)

6933

NEUTRON-TRANSFER REACTIONS FROM THE NITROGEN BOMBARDMENT OF Be, C, O, Na, AND $Mg^{24,25,26}$. M. L. Halbert, T. H. Handley, J. J. Pinajian, W. H. Webb, and A. Zucker (Oak Ridge National Lab., Tenn.). Phys. Rev. 106, 251-6(1957) Apr. 15.

Excitation functions were measured for neutron-transfer reactions yielding N^{13} from the nitrogen bombardment of Be, C, O, Na, Mg^{24}, Mg^{25}, and Mg^{26}. At the maximum incident energy of 27.5 Mev, the cross section varies from 0.14 mb for oxygen to 2.8 mb for magnesium-25. Nitrogen-13 was separated chemically from the targets and counted as ammonium tetraphenylboron. The chemical method was checked by measuring yields of both reaction products, N^{13} and Mg^{27}, in the reaction $Mg^{26}(N^{14},N^{13})Mg^{27}$. By plotting the transfer cross sections as a function of $E^* = E_{c.m.} - E_{barrier} + Q$, a systematic behavior of all the cross sections is displayed. (auth)

6934

GAMMA RAYS FROM THE PROTON BOMBARDMENT OF N^{15}. S. Bashkin and R. R. Carlson (State Univ. of Iowa, Iowa City). Phys. Rev. 106, 261-6(1957) Apr. 15.

The yield of 4.43-Mev γ rays from the reaction $N^{15}(p,\alpha\gamma)C^{12}$ has been measured for proton energies between 800 and 4020 kev. A gas target, enriched to 61% in N^{15}, was used. New resonances were observed at bombarding energies of 1985 ± 20 kev, 3000 ± 30 kev, 3300 ± 35 kev, 3350 ± 50 kev, and 3520 ± 40 kev, with widths of 25 ± 5 kev, 45 ± 10 kev, 75 ± 15 kev, 750 ± 100 kev, and 100 ± 25 kev, respectively. The width of the previously known resonance at 1650 ± 15 kev was measured to be 65 ± 10 kev. Angular distributions for the 4.43-Mev γ rays were measured at eight energies, included all the observed resonances. Spin and parity assignments are made to the resonant states. The $N^{15}(p,\gamma)O^{16}$ yield was measured for proton energies between 850 kev and 3300 kev, but no new resonances were seen. The width of the known 1050-kev resonance was measured to be 125 ± 25 kev. (auth)

6935

DIRECT NUCLEAR REACTIONS. S. T. Butler (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 106, 272-83 (1957) Apr. 15.

It is the contention of this paper that the large majority of nuclear reactions which proceed to a low-lying level of the final nucleus are predominantly direct reactions with stripping-like angular distributions. It is seen that reactions of the form (n,p), (p,p'), (α,α'), (α,p), etc. have essentially as much chance of proceeding directly as does the deuteron stripping of pickup reaction. This latter reaction no longer appears in a category of its own, but merely as one example of a whole gamut of types of reactions which proceed via a characteristic direct process. Differential cross sections for the general class of direct reaction are calculated, and closed-form expressions obtained by means of the same approximations originally employed for the deuteron stripping reaction. It is seen that the angular distributions are dependent on the spins and parities of the initial and final nuclei involved, and are thus capable of yielding information regarding these properties; moreover the absolute magnitudes are capable of yielding interesting information concerning nuclear structure. Comparisons between theory and experiment are made for a few typical reactions. (auth)

6936

PHOTODISINTEGRATION OF C^{13}. Barnett C. Cook (Univ. of Chicago, Ill.). Phys. Rev. 106, 300-14(1957) Apr. 15.

The neutron yield functions of C^{12} and C^{13} from bremsstrahlung up to 41 Mev have been measured by using direct neutron detection. The photoproton yield function for C^{13} has also been measured by detecting the B^{12} activity. These yield functions were converted into cross sections (σ) by a slightly modified standard method. σ for $C^{13}(\gamma,xn)$ exhibits a peak of ~3.7 mb at ~13.5 Mev and the "giant resonance" peak of ~10 mb at ~24 Mev. This latter peak is broad [$\Gamma_{\frac{1}{2}} \approx 10$ Mev] in contrast to C^{12} with $\Gamma_{\frac{1}{2}} \approx 3$ Mev. σ for $C^{13}(\gamma,p)B^{12}$ exhibits a broad ($\Gamma_{\frac{1}{2}} \approx 6$ Mev) giant resonance peak of 8.8 mb at 25.5 Mev. This large p/n emission ratio cannot be accounted for by statistical considerations. After a reasonable allowance is made for multiple processes, these two measurements are combined to give the total γ-absorption cross section, σ_{abs}. σ_{abs} of C^{12} is also discussed. Both show a giant resonance peak but $\Gamma_{\frac{1}{2}}(C^{13}) \gg \Gamma_{\frac{1}{2}}(C^{12})$ whereas the integrals of σ_{abs} over the resonance are approximately equal. The idea that core

excitation is responsible for the giant resonance is supported by the approximate equality of the resonance energies of C^{12} and C^{13}, but the remarkable difference in the width of these resonance peaks suggests a strong dependence of the absorption process on the ground-state configurations. The peak at 13.5 Mev found in $C^{13}(\gamma,n)$ is still present in σ_{abs} and hence is not due to competition, but represents a "pygmy resonance." During this work a new half life for B^{12} was obtained: $(18_{-1.3}^{+1.5})$ msec. (auth)

6937

CATALYSIS OF NUCLEAR REACTIONS BETWEEN HYDROGEN ISOTOPES BY μ^- MESONS. J. D. Jackson (Princeton Univ., N. J.). Phys. Rev. 106, 330-9(1957) Apr. 15.

The mechanism by which negative μ mesons catalyze nuclear reactions between hydrogen isotopes is studied in detail. The reaction rate for the process ($p + d + \mu^- \rightarrow He^3 + \mu^- + 5.5$ Mev), observed recently by Alvarez et al., is calculated and found to be in accord with the available data. The μ^- meson binds two hydrogen nuclei together in the μ-mesonic analog of the ordinary H_2^+ molecular ion. In their vibrational motion the nuclei have a finite, although small, probability of penetrating the Coulomb barrier to zero separation where they may undergo a nuclear reaction. The intrinsic reaction rates for other, more probable, reactions are also estimated. The results are $\sim 0.3 \times 10^6$ sec^{-1} for the observed p–d reaction, $\sim 0.7 \times 10^{11}$ sec^{-1} for the d–d reaction, and $\sim 0.4 \times 10^{13}$ sec^{-1} for the d–t reaction. For the reaction observed by Alvarez rough estimates are made of partial widths for nonradiative and radiative decay of the excited He^3 nucleus. The ejection of the μ^- meson by "internal conversion" seems somewhat less likely. Speculations are made on the release of useful amounts of nuclear energy by these catalyzed reactions. The governing factors are not the intrinsic reaction rate once the molecule is formed, but rather the time spent ($\sim 10^{-8}$ sec) by the μ^- meson between the breakup of one molecule and the formation of another and the loss of μ^- mesons in "dead-end" processes. These factors are such that practical power production is unlikely. In liquid deuterium, each μ^- meson will catalyze only ~ 10 reactions in its lifetime, while for the d–t process it will induce ~ 100 disintegrations. A longer lived particle will not be able to catalyze appreciably more reactions. (auth)

6938

PHOTODISINTEGRATION OF HELIUM. M. L. Rustgi and J. S. Levinger (Louisiana State Univ., Baton Rouge). Phys. Rev. 106, 530-5(1957) May 1.

The sum-rule calculations of Levinger and Bethe are extended to include two-body Heisenberg and tensor forces. These sum rules are applied to calculate for the alpha particle the bremsstrahlung-weighted cross section (σ_b) and the integrated cross section (σ_{int}) using Irving's wave functions for tensor force. Results are compared with values found from experiments integrated to 150 Mev. The experimental values are $\sigma_b = 2.7$ mb and $\sigma_{int} = 124$ Mev-mb, while the theoretical values are found to be $\sigma_b = 1.23$ mb and $\sigma_{int} = 60[1 + 0.70(x + \frac{1}{2}y) + 0.18(x' + \frac{1}{2}y')]$ Mev-mb. Here x and x' are the fractions of central and tensor potentials, respectively, that have Majorana exchange character; y and y' represent fractions of the central and tensor potentials that have Heisenberg exchange character. The low theoretical values for σ_b may be related to the small root-mean-square radius of the alpha particle given by Irving's wave function. The photodisintegration experiments seem to support Hofstadter's value for the size of the alpha particle, when one takes account of the proton size in his electron-scattering experiments. (auth)

6939

POLARIZATION IN THE $H^2(d,p)H^3$ REACTION. R. E. Segel and S. S. Hanna (Johns Hopkins Univ., Baltimore, Md.). Phys. Rev. 106, 536-9(1957) May 1.

The polarization of the protons in the $H^2(d,p)H^3$ reaction has been measured at a deuteron energy of 0.64 Mev in the laboratory system, and a proton angle 45° in the center-of-mass system. The deuterium gas target was approximately 70 kev thick. Scattering in helium gas was used to measure the polarization. Corrections for geometrical asymmetries were determined by comparing the scattering in helium with scattering in xenon gas. Measurements made at three different proton energies yield an average value of $-(17 \pm 7)\%$ for the polarization. The negative sign signifies a direction opposite the vector $[V_d \times V_p]$, where V_d and V_p are the deuteron and proton velocities, respectively. (auth)

PARTICLE ACCELERATORS

6940 MURA-254

Midwestern Universities Research Assn., Madison, Wis.
A RADIO FREQUENCY SYSTEM FOR EXPERIMENTS WITH THE FFAG ELECTRON MODEL. K. M. Terwilliger. Apr. 1957. 14p. Contract AT(11-1)-384. $3.30(ph); $2.40(mf OTS).

A frequency modulated oscillator using ferroelectric capacitors has been constructed for r-f experiments with the FFAG electron model. The system gives about 50 peak r-f volts and a frequency swing from 65 to 75 Mc on the 150 $\mu\mu f$ vacuum tank gap. Closely spaced frequency modulated r-f pulses, up to four or five per millisecond, are available for r-f beam stacking and other experiments. (auth)

6941 MURA-255

Midwestern Universities Research Assn., Madison, Wis.
RADIO FREQUENCY EXPERIMENTS WITH AN FFAG ELECTRON MODEL ACCELERATOR. K. M. Terwilliger, L. W. Jones, and C. H. Pruett. Apr. 1957. 21p. Contract AT(11-1)-384. $6.30(ph OTS); $3.00(mf OTS).

Radio frequency experiments performed on the FFAG electron model accelerator demonstrate predictions of the Symon-Sessler r-f acceleration theory. In particular, the experiments show the phenomena of phase displacement in which a frequency modulated r-f pulse, with frequency starting below that of a coasting beam, and sweeping through it, captures only a few particles and decreases the energy of the remainder a predictable amount. Measurements of the amount of average and peak energy loss of the coasting beam are in rough quantitative agreement with the theoretical predictions. Some qualitative tests are made which demonstrate beam stacking. (auth)

6942 UCRL-3682

California. Univ., Berkeley. Radiation Lab.
THE EFFECT OF RATE OF RISE OF MAGNETIC FIELD ON THE ACCEPTANCE TIME OF THE BEVATRON. Harry G. Heard. Feb. 12, 1957. 13p. Contract W-7405-eng-48. $0.20(OTS).

The acceptance time of the Bevatron has been measured for three different rates of rise of magnetic field. These data indicate that the acceptance time varies inversely with rate of change of magnetic field. An analysis is given of the variation of the probability of an injected proton's striking the inflector on successive turns. This analysis, which is idealized to a circular machine and assumes linear betatron oscillations, shows that the probability of missing the inflector varies slowly with the rate of change of magnetic field. (auth)

6943

THE ELECTRON LINEAR ACCELERATOR AS A PULSED

RADIATION SOURCE. M. G. Kelliher, J. C. Nygard, and A. J. Gale (High Voltage Engrg. Corp., Cambridge, Mass.). IRE Trans. Nuclear Sci. NS-3, No. 3, 1-7(1956) June.

One of the inherent properties of the electron linear accelerator is that it produces radiation in pulses whose duration is less than the pulse duration of the ratio frequency source from which it is fed. In practice the pulse length lies in the range from one to five microseconds. However, by independently pulsing the electron source or injector, intense pulses of radiation of duration 0.1 μsec or less can be easily achieved and the lower limit is set only by stray capacitance effects. The radiation produced can be electrons, x rays, or neutrons (by gamma-n reaction). One of the more important practical applications in nuclear research is as a pulsed neutron source in time-of-flight neutron spectroscopy where the short duration and high flux, when used with appropriate analyzing circuitry, provide a spectrometer of high resolving power in the intermediate neutron range. Short bursts of radiation also find application in radio-chemistry where physicochemical changes often occur in a very short interval after the absorption of radiation. (auth)

Refer also to abstract 6785.

RADIATION ABSORPTION AND SCATTERING

6944 WADC-TN-57-117 (Rpt: UNCLASSIFIED) Wright Air Development Center. Power Plant Lab., Wright-Patterson AFB, Ohio.

p- AND d- SCATTERING CORRECTIONS TO THE AVERAGE LOGARITHMIC ENERGY DECREMENT AND TO THE AVERAGE VALUE OF THE COSINE OF THE SCATTERING ANGLE. Arthur L. Kaplan. Nov. 16, 1956. 34p. Project No. 3162.

Analytical expressions are obtained for corrections to the average logarithmic neutron energy decrement and to the average value of the cosine of the neutron scattering angle, due to p and d scattering of neutrons. (B.J.H.)

6945

MEASUREMENT OF THE ELASTIC SCATTERING OF 1.33-Mev γ RAYS IN TIN. Eiichi Hara, Jean Banaigs, and Jacques Mey. Compt. rend. 244, 2155-7(1957) Apr. 15. (In French)

Results of measurements of the elastic scattering of Co^{60} γ rays in tin are given. These results agree well with recent theoretical calculations. No scattering by the electric field of the nucleus was found. (tr-auth)

6946

CONTRIBUTION OF THE ELECTRIC FIELD OF NUCLEI TO THE ELASTIC SCATTERING OF Co^{60} γ RAYS. L. Goldzahl and P. Eberhard. J. phys. radium 18, 33-43 (1957) Jan. (In French)

6947

NUCLEON-NUCLEON SCATTERING BY NON CENTRAL FORCES. II. PROTON-PROTON SCATTERING. M. Gourdin. J. phys. radium 18, 85-91(1957) Feb. (In French)

6948

THE ELASTIC SCATTERING OF ELECTRONS. R. Zouckermann. J. phys. radium 18, 133-7(1957) Feb. (In French)

6949

ELASTIC SCATTERING OF PHOTONS BY COPPER. J. B. Bellicard, J. Miller, and C. Tzara. J. phys. radium 18, 201-2(1957) Mar. (In French)

6950

ON SCATTERING AT VERY HIGH ENERGIES. K. Symanzik (Univ. of Chicago, Ill.). Nuovo cimento (10) 5, 659-65(1957) Mar.

The asymptotic behavior of the scattering amplitude at very high energies is discussed on the basis of the general dispersion relations and the unitarity requirement. The assumption that the tangent approximation fulfills the dispersion relation leads to the prediction that the total cross section cannot asymptotically increase as strongly as proportional to the laboratory energy. The relevance of this result is discussed. (auth)

6951

ANALYSIS OF POLARIZATION IN NEUTRON-PROTON SCATTERING. Y. Takano and M. H. Hull, Jr. (Yale Univ., New Haven, Conn.). Phys. Rev. 106, 321-6(1957) Apr. 15.

An analysis of polarization in neutron-proton scattering experiments is described, and phase shifts of S and D waves for 310 Mev are presented. The calculation to obtain the S and D phase shifts has been arranged, assuming charge independence, to make use of experimental p-p polarization information in order not to depend on specific phase shift analyses of these data. The results indicate ranges of values of the phase shifts in which charge-independent fits to n-p and p-p data may be expected to exist. (auth)

6952

INELASTIC SCATTERING OF 40.2-Mev ALPHA PARTICLES. G. Igo (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 106, 256-60(1957) Apr. 15.

The differential cross section $d^2\sigma/dEd\Omega$ has been measured at 25, 45, 90, 135, and 150 degrees in the laboratory system for the inelastic scattering of 40.2-Mev alpha particles from Al, V, Cu, Nb, Ag, Ta, and Th. Spectra obtained at 135 and 150 degrees have been analyzed in terms of the statistical theory of nuclear reactions. The differential cross section measured at smaller angles is incompatible with the statistical theory of nuclear reactions. A group of alpha particles with energy well below the Coulomb barrier is observed in the spectra of Ta and Th at large angles. (auth)

6953

SLOW-NEUTRON SCATTERING BY MOLECULES. T. J. Krieger and M. S. Nelkin (Knolls Atomic Power Lab., Schenectady, N. Y.). Phys. Rev. 106, 290-5(1957) Apr. 15.

The operator formalism in slow-neutron scattering theory introduced by Wick and By Zemach and Glauber is considered in an approximation in which molecular rotational and vibrational effects are explicitly separated. The combined effects of rotation and translation are treated in terms of the Sachs-Teller "mass-tensor" concept, which is rederived on the basis of a rigid molecule Hamiltonian and extended to include interference effects. Only elastic vibrational transitions from the ground vibrational state are considered. The applicable neutron energy range is restricted to values large compared to the rotational level separation but below the vibrational threshold. The method is applicable to the calculation of differential as well as total scattering cross sections and to molecules of arbitrary structure. Expressions in closed form for these cross sections are obtained through use of an approximate procedure for averaging over molecular orientations. In the case of hydrogenous molecules, where direct scattering is dominant, the scattering by a given nucleus is described in terms of two parameters, viz., an effective nuclear mass for rotation and translation, and a vibrational constant. The relative simplicity of the method is illustrated in the calculation of the differential and total cross sections of CH_4 and the total cross section of H_2. Agreement of these calculations with experiment and with other calculations is good. (auth)

6954

SPATIAL DISTRIBUTION OF ENERGY ABSORBED FROM

AN ELECTRON BEAM PENETRATING ALUMINUM. F. N. Huffman, J. S. Cheka, B. G. Saunders, R. H. Ritchie, and R. D. Birkhoff (Oak Ridge National Lab., Tenn.). Phys. Rev. 106, 435-40(1957) May 1.

An electron beam introduced into an infinite medium is scattered and absorbed as the electrons slow down. The ionization produced by the beam in a plane air cavity perpendicular to the initial beam direction was used to measure the spatial rate of energy dissipation at various distances from the plane of incidence. At beam energies of 57, 80, 104, and 126.5 kev, agreement within a few percent on an absolute basis with the Spencer theory of electron penetration was found if the value of W, the average energy to make an ion pair, is taken for air to be 34 electron volts per ion pair. (auth)

6955

NEUTRON-PROTON SCATTERING AT 90 MEV. Chung Ying Chih and Wilson M. Powell (Univ. of California, Berkeley). Phys. Rev. 106, 539-44(1957) May 1.

An investigation of 90-Mev neutrons scattered by protons has been conducted with a cloud chamber filled with hydrogen or with a mixture of methane and hydrogen in a magnetic field of 22,000 gauss. The neutron energy spectrum has a full width at half-maximum of about 30 Mev. The neutron scattering angles range from 8° to 180° in the center-of-mass system. The differential scattering cross section is found to have a symmetry about 90° in the center-of-mass system. (auth)

6956

POLARIZATION OF HIGH-ENERGY NUCLEONS SCATTERED BY CARBON. K. Nishimura and M. Ruderman (Univ. of California, Berkeley). Phys. Rev. 106, 558-60 (1957) May 1.

Analyses of the polarization of elastically scattered 289-Mev protons from carbon show that it is difficult to understand the observed polarization even when a large variety of well shapes and parameters are introduced. The contribution from almost elastic scattering by C^{12} (excitation of the 4.3-Mev level) is calculated on the assumption that a low-lying energy level which is strongly excited can be considered a collective excitation. Then in the Born approximation the polarization is exactly the same as for elastic scattering, but more precise calculations show important differences. Separation of the elastic and inelastic polarization contributions with partial cross sections inferred from electron scattering and 96-Mev nucleon scattering is in qualitative agreement with observation. (auth)

6957

PROTON POLARIZABILITY CORRECTION TO ELECTRON-PROTON SCATTERING. S. D. Drell (Stanford Univ., Calif.) and M. A. Ruderman (Univ. of California, Berkeley). Phys. Rev. 106, 561-3(1957) May 1.

The contribution to observed electron-proton scattering cross sections of the electron-induced polarization of the proton is estimated and found to be small for electron energies <500 Mev. (auth)

RADIATION EFFECTS

6958 CF-57-4-80

Oak Ridge National Lab., Tenn.

POSSIBLE RADIATION DAMAGE TO THE STATOR WINDINGS OF THE HRT CIRCULATING PUMP. E. [H.] Gift. Apr. 17, 1957. 14p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A study of the degree and effects of radiation damage to the motor winding of the HRT 400-A canned motor circulating pumps was made. (W.L.H.)

6959 SC-4046(M)

Sandia Corp., Albuquerque, N. Mex.

UNCLASSIFIED PORTION OF RADIATION EFFECTS BIBLIOGRAPHY. S. T. Landrith, comp. Mar. 1, 1957. 52p. Contract [AT-(29-1)-789]. $9.30(ph OTS); $3.60 (mf OTS).

6960

IONS PRODUCED BY X-RAYS IN THE AIR AT ATMOSPHERIC PRESSURE. Arvids Metnieks (Univ. of Uppsala, Sweden). Arkiv Fysik 11, No. 5, 481-93(1957).

Small ions formed in the atmospheric air by x rays are measured. Ions of both signs are produced with approximately the same abundance. Frequently two groups with different mobilities have been found, especially in the case of positive ions. It is found that practically no large ions are generated by x rays, but when the atmosphere already contains large ions, x raying increases their concentration by 10 to 20% on account of the uncharged part of the nuclei. Conditions are discussed under which it is permissible to interchange n-values and $\bar{n}$-values when drawing characteristics, that is, interchanging the instantaneous ion concentration and its accumulative value. (auth)

6961

EFFECTS OF FAST NEUTRONS ON SOME PHYSICAL CONSTANTS OF CRYSTALLINE QUARTZ AND OF VITREOUS SILICA. Guy Mayer and Jean Gigon. J. phys. radium 18, 109-14(1957) Feb. (In French)

6962

CROSS SECTION FOR DISPLACEMENT OF ATOMS BY HEAVY PARTICLE IRRADIATION. Takeshi Morimoto (Kyoto Univ., Japan). J. Phys. Soc. Japan 12, 442(1957) Apr.

Refer also to abstract 6920.

RADIOACTIVITY

6963 NP-6280

Brussels. Centre D'Etudes Pour Les Applications de l'Energie Nucleaire.

MESURE DES ACTIVITES DES EAUX DE PLUIE ET DE SURFACE. (Measurement of the Activities of Rain and Surface Waters). R. Boulenger. June 30, 1956. 17p. (B-1241).

6964

PLATINUM K X-RAYS FROM RADIUM SOURCES. Jan Cederlund (Univ. of Lund, Sweden). Arkiv Fysik 11, No. 5, 431-5(1957).

The platinum K x rays generated in the walls of a radium container were studied with a scintillation spectrometer. Special measures were adopted to reduce and correct for the strong Compton background due to the hard gamma rays from radium. A source, the rays of which simulated the hard beta rays from RaC, was used to estimate what proportion of the observed peak was due to beta rays from RaC. The number of photons in the K x ray peak was found to be 0.030 per radium disintegration, or 1.4 per cent of the total number of photons emitted from the source. (auth)

6965

GAMMA LINES FROM K^{43}. Gunnar Backstrom and Torsten Lindqvist (Inst. of Physics, Uppsala, Sweden). Arkiv Fysik 11, No. 5, 465-6(1957).

Potassium-43 was obtained as a spallation product from bombarding vanadium with 190-Mev protons in a synchrocyclotron. The gamma energies were redetermined with a precision spectrometer and γ-γ coincidence experiments. Results are discussed. (M.H.R.)

6966
STUDY OF THE K-AUGER ELECTRONS AND THE CONVERSION ELECTRONS OF Co^{57}. J. B. Bellicard and A. Moussa. J. phys. radium 18, 115-20(1957) Feb. (In French)

6967
ABSOLUTE INTENSITIES OF L X-RAYS AND GAMMA RAY IN RaD DECAY. Richard W. Fink (Univ. of Arkansas, Fayetteville). Phys. Rev. 106, 266-71(1957) Apr. 15.

The absolute intensity of L x rays/RaD disintegration (F) has been measured to be $0.23_8 \pm 0.02$ by argon-filled proportional counter spectrometry on carrier-free RaDEF equilibrium sources, and the relative intensities were found to be $L_\alpha : L_\beta : L_\gamma :: 1.0 : 1.1 : 0.19$. The intensity of L x rays relative to that (R) of the single, 46.5-kev, pure M1 gamma ray is $F/R = 5.1 \pm 0.7$. Care was taken to avoid error due to wall effects and the counting techniques were varied and cross checked so as to eliminate possible systematic errors. The absolute intensity of the gamma ray is $R = 0.045 \pm 0.004$ from data taken on a 3 × 3 inch NaI(Tl) scintillation spectrometer. Assuming the number of L-shell ionizations/RaD disintegration (I) to be 0.62, the mean L-fluorescence yield (F/I) of bismuth is 0.38 ± 0.02, which when combined with the ratio F/R, leads to an experimental value of the total L-shell conversion coefficient (I/R), which thus is 13.3 ± 2.0, the major error arising from the correction of R for the contribution due to Compton backscattering, which amounts to some 10 to 20% depending on exact conditions of geometry and collimation. The value of the L-conversion coefficient interpolated from Rose's tables is 17.85, based on a point-charge nucleus. Better agreement is obtained with a value of about 12.7 from theoretical calculations of Sliv and Listengarten, who included a correction for the finite size of the nucleus. A new summary of mean L-fluorescence yields from nuclear excitation is presented which shows that the mean yields depend strongly upon the relative number of vacancies in the respective L subshells. (auth)

6968
LOW INTENSITY TRANSITIONS IN THE DECAY OF Be^{214}, Tl^{210}, AND Tl^{208}. H. Daniel. Z. Naturforsch. 12a, 194-200 (1957) Mar. (In German)

An anthracene scintillation counter with single-channel pulse height selection was used as a low-background detector in a magnetic-lens β-ray spectrometer. By analyzing the spectrum of the Compton electrons ejected from a thick converter three new γ rays in the decay RaC → RaC′ were found: 2.72 ± 0.02 Mev, 2.89 ± 0.05 Mev, and 3.03 ± 0.03 Mev, with intensities of 0.026, 0.005, and 0.013, resp., setting the intensity of the 2.204-Mev γ ray equal to unity. β-ray groups, if existing, from RaC′′ to RaD-levels ≤ 1.07 Mev have an intensity $< 5 \times 10^{-3}$ per RaC′′ decay. The upper limit for the intensity of a 3.20-Mev crossover γ ray in the decay ThC′′ → ThD was measured to 1.5×10^{-4} per ThC′′ decay. (auth)

SHIELDING

6969
SHIELDING AGAINST NUCLEAR RADIATION. C. E. Iliffe (U.K.A.E.A., Industrial Group, Risley). J. Brit. Nuclear Energy Conf. 1, 241-60(1956) July.

The characteristics of neutron radiation are first described and the concepts of cross-section, flux, and current density defined. Fick's Law of Diffusion as applied to neutrons then leads readily to the two-group theory of neutron diffusion as used in reactor theory, with the additional concepts of diffusion, slowing-down and extrapolation lengths. The shortcomings of the two-group theory in shielding problems are emphasized. The properties and sources of gamma rays are discussed. It is shown that the concepts of cross-section, flux and current density are still applicable but that the diffusion treatment described for neutrons must be replaced by one in which primary gamma rays, which have so far escaped interaction with matter, are multiplied by a build-up factor to arrive at the effective radiation. A brief reference is made to alpha- and beta-particles and to fission fragments. The generation of gamma radiation arising from neutron capture, and from the radioactive decay of fission products or neutron activated materials is dealt with. Tables are given of the radiation emitted by various materials due to any of these causes. The maximum permissible level of radiation is introduced, and the concept of shielding by distance referred to. The shielding of a nuclear reactor is described, taking the Windscale Thermal Reactor as an illustration, and radiation from a reactor coolant circuit is investigated. The paper concludes with a discussion of heat generation in shields and of likely future developments. (auth)

6970
THE EVALUATION OF RADIATION PROTECTION MATERIAL IN CONTACT WITH GAMMA RADIATION FROM RADIOACTIVE ISOTOPES. Hellmut Glubrecht. Strahlentherapie 102, 489-96(1957) Mar. (In German)

Valuation of substances providing protection from the gamma radiation of radioactive isotopes can be done only in first approximation by their densities. Apart from this, the following items have to be taken into consideration: the spectral composition of the incident radiation, the geometrical conditions for the attenuation of rays, especially with regard to dispersion, the energetic nature of the rays coming out, and the stability of the material towards very high doses of rays. A number of examples have proved lead and special kinds of concrete of high density to be favorable not only as concerns economy in space, but also with regard to the problem of diffuse radiation. (auth)

SPECTROSCOPY

6971 TT-654
EFFECT OF VARYING ARGON PRESSURE IN AN ELECTRODELESS DISCHARGE ON THE REPRODUCTION OF THE WAVE-LENGTH OF THE RED LINE OF Cd^{114} (Vliianie Izmeneniia Davleniia Argona v Bezelektrodnom Razriade na Vosproizvedenie Dliny Volny Krasnoi Linii Cd^{114}.) N. R. Batarchukova and G. B. Dobrovskii. Translated by G. Belkov from Optika i Spektroskopiya 1, 330-3 (1956). 9p.

6972
THE ROTATIONAL ANALYSIS OF THE SINGLET SYSTEM B OF ZIRCONIUM OXIDE. THE λ 8192 BAND-SYSTEM. Lars Akerlind (Univ. of Stockholm). Arkiv Fysik 11, No. 5, 395-404(1957).

A rotational analysis of the green singlet band-system B of zirconium oxide has been carried out. It has no connection with the singlet system A, as is suggested by the agreement of the vibrational constants. The 0,0 and 1,0 bands have been analyzed. Besides the main lines belonging to the molecule $Zr^{90}O^{16}$, also isotope lines ($Zr^{91}O^{16}$, $Zr^{92}O^{16}$, $Zr^{94}O^{16}$) have been identified. The rotational constants of the main isotope are given. System B is regarded as a $^1\Sigma - {}^1\Sigma$ or a $^1\Delta - {}^1\Delta$ transition. Its upper and lower states are called d and c respectively. Finally, the group of ZrO bands round 8192 A is briefly discussed. (auth)

6973
STRUCTURE OF NEUTRON-IRRADIATED QUARTZ AND VITREOUS SILICA. Ivan Simon (Arthur D. Little, Inc., Cambridge, Mass.). J. Am. Ceram. Soc. 40, 150-3(1957) May.

The structure of quartz and vitreous silica disordered by heavy irradiation (10^{20} neutrons per $cm.^2$) of fast neutrons was studied by means of x-ray-diffraction and infrared spectroscopy. The results indicate that the structure of the disordered amorphous form of silica resembles closely that of vitreous silica. The average Si–O distance (1.61 a.u.) remains unchanged, but the average Si–O–Si bond angle decreases from 142° to 138°; the radial distances of the more distant neighbor atoms show a wider distribution in the disordered material. It is suggested that the disordered form of silica results from thermal effects (thermal spikes) accompanying the passage of knocked-on atoms through the solid. (auth)

6974

METHOD OF OBTAINING DERIVATIVE SPECTRA. J. Paul Pemsler (Goodyear Atomic Corp., Portsmouth, Ohio). Rev. Sci. Instr. 28, 274-5(1957) Apr.

The first derivative with respect to wavelength of the transmission curve has been used to detect overlapping spectral bands. The commercially available Perkin-Elmer Model 13 Ratio Recording Spectrophotometer may be easily adapted to record directly the derivative spectrum throughout the ultraviolet, visible, and infrared regions. (auth)

THEORETICAL PHYSICS

6975 AECU-3459

RAND Corp., Santa Monica, Calif.

THOMAS-FERMI EQUATION OF STATE FOR DILUTE GASES. Richard Latter. Jan. 3, 1957. 22p. For Univ. of Calif. Radiation Lab. Contract [W-7405-eng-48], Subcontract SC-101. (RM-1847-AEC; AD-123511). $7.80(ph OTS); $3.30(mf OTS).

The electronic component of the equation of state of very dilute gases has been obtained using the Thomas-Fermi model and following the methods described in RAND report RM-1227-AEC. Curves of $P/Z^{10/3}$ vs. ZV at constants $kT/Z^{4/3}$ and S/Zk and $(E_T - E_T^*)/Z^{7/3}$ vs. ZV at constant $kT/Z^{4/3}$ are shown in the following graphs. The data cover the regions $10^{-14} cm^3 \geq ZV \geq 10^{-18} cm^3$ for 10^{12} dynes/$cm^2 \geq P/Z^{10/3} \geq 10^{-3}$ dynes/cm^2 and $10^{-19} cm^3 \geq ZV \geq 10^{-22} cm^3$ for 10^2 dynes/$cm^2 \geq P/Z^{10/3} \geq 10^{-3}$ dynes/cm^2. (auth)

6976

ON THE THEORY OF LIQUIDS. Louis Goldstein (Los Alamos Scientific Lab., N. Mex.). Ann. Phys. 1, 33-57 (1957) Apr.

The present paper concerns the exact analytic forms of correlation functions of liquids and some of their macroscopic properties which these correlations determine. Since these functions are expressible in terms of the scattering structure factors of liquids, the macroscopic properties they define will be described in terms of the properties of the structure factors. One is then led, with some limitations, to a rigorous result on the behavior of pair potential energies of isolated stationary atoms at close separations. Part of the paper is devoted to a discussion of some of the limitations of the experimentally derived structure factors as well as the liquid correlation functions to which they give rise. It will be shown, on the basis of liquid helium data, that improvements in the empirical correlation functions as well as the various macroscopic liquid properties they define, require the knowledge of the structure factors over a far wider range of the momentum changes on scattering than obtained heretofore. The final topic concerns a detailed study of the asymptotic, large atomic separation, behavior of the correlation functions. The temperature limitations of a direct method yielding these asymptotic forms will be obtained. A new method of derivation of these forms, involving the scattering structure factors, will be described. This same method also leads to the asymptotic form of the structure factors themselves, at large values of the momentum changes on scattering. These latter asymptotic structure factors retain their validity over the whole temperature interval of existence of liquids. (auth)

6977

ELECTROMAGNETIC PROPERTIES OF NUCLEONS AND BARION-HEAVY MESON INTERACTIONS. B. Vitale. Nuovo cimento (10) 5, 732-6(1957) Mar.

6978

ON THE CONSERVATION OF NUCLEONS. B. Ferretti (CERN, Genéve). Nuovo cimento (10) 5, 761(1957) Mar.

6979

ENERGY DEPENDENCE OF CROSS SECTIONS NEAR THRESHOLD: NEUTRAL PARTICLES. William H. Guier and Robert W. Hart (Johns Hopkins Univ., Silver Spring, Md.). Phys. Rev. 106, 296-9(1957) Arp. 15.

A procedure is developed for determining the excess-energy dependence near threshold of reaction cross sections involving the escape of an arbitrary number of neutral particles. It is somewhat analogous to Wigner's procedure in that only an asymptotic solution of Schrödinger's equation is used, but is more readily applied to many-particle escape because it does not require the explicit matching of this solution at a reaction zone boundary. Explicit samples include the escape of two identical particles with arbitrary angular momentum, and the escape of an arbitrary number of identical particles with zero angular momentum. (auth)

6980

RELATIVISTIC CORRECTIONS TO p-p SCATTERING. G. Breit (Yale Univ., New Haven, Conn.). Phys. Rev. 106, 314-20(1957) Apr. 15.

Effects of wave function distortion by nuclear forces of nonelectromagnetic origin are qualitatively considered. It is found that the relativistic corrections to the Coulomb wave contain effects of wave function distortion which may affect these corrections by reasonably large fractional amounts. The spin-orbit interactions arising from the action of the electric field are found to be affected by wave function distortion. Since these interactions affect the polarization of proton beams in double and triple scattering, the analysis of high-energy data is affected. The theory of spin-orbit interactions is brought into relation with that of atomic spectra. The unreliability of contact terms contained in the relativistic corrections is brought out. A concise proof of the vanishing of first-order tensor force effects on the polarization applying independently of the origin of the tensor force effects is supplied in an appendix. (auth)

6981

REMARKS ON POSSIBLE NONINVARIANCE UNDER TIME REVERSAL AND CHARGE CONJUGATION. T. D. Lee (Columbia Univ., New York) and Reinhard Oehme and C. N. Yang (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 106, 340-5(1957) Apr. 15.

Interrelations between the nonconservation properties of parity, time reversal, and charge conjugation are discussed. The results are stated in two theorems. The experimental implications for the $K-\bar{K}$ complex are discussed in the last section. (auth)

6982

FERMI DECAY OF HIGHER SPIN PARTICLES. R. E. Behrends and C. Fronsdal (Univ. of California, Los Angeles). Phys. Rev. 106, 345-53(1957) Apr. 15.

The explicit form for the spin projection operators introduced by Fronsdal is calculated for arbitrary spin and applied to first-order processes involving four fermions.

The matrix element for the most general nonderivative interaction is found for the special case in which two of the particles have spin ½. The method of relating matrix elements written in different orders is extended to this case. The theory is applied to the decay of the mu meson, extending the work of Caianiello. It is found that the experimental decay spectrum can be equally well fitted by an assignment of spin ½ or ³⁄₂. The method is then applied to the Fermi decay of hyperons. Lifetimes are calculated for decays in which the initial particle has a spin of ½ or ³⁄₂, and the final particles all have spin ½. All the lifetimes are less than 2 orders of magnitude longer than the corresponding observed lifetimes for the normal mode of decay. The hypothesis of a universal Fermi interaction is extended to include fermions of arbitary spin. Under this hypothesis, the experimental muon spectrum is most closely reproduced with spin ³⁄₂. The results also indicate that the muon has the same particle-antiparticle character as an electron of the same charge. (auth)

6983

PARITY DOUBLETS AND HYPERFRAGMENT BINDING. Laurie M. Brown (Northwestern Univ., Evanston, Ill.). Phys. Rev. 106, 354-7(1957) Apr. 15.

The Thomas variation-iteration method is applied to a model of a hypernucleus in which the binding arises from a potential which mixes orbital states of opposite parity, a situation which may prevail if the Λ^0 has the parity doublet structure suggested by Lee and Yang. The P-state part of the ground state increases with the mass of the hyperfragment and may have a probability as large as 20% for mass number 8, with correspondingly large effect upon the decay rate of the fragment and upon the ratio of mesonic to nonmesonic decay. (auth)

6984

COMPOUND MODEL FOR HEAVY PARTICLES. R. W. King (Purdue Univ., Lafayette, Ind.) and D. C. Peaslee (Univ. of California, Berkeley). Phys. Rev. 106, 360-3 (1957) Apr. 15.

A static model is considered in which all heavy particles are compounded out of two basic units, taken here to be the Λ and nucleon N (and/or the cascade particle Ξ). The model suggests the existence of some unstable particle states accessible to experiment: the ρ meson, a boson with I = 0; the Λ^{**}, a highly excited I = 0 state of the Λ; the Z hyperon unstable against rapid decay by $Z \rightarrow K + N$. Without artificial assumption the model directly indicates that in the present strangeness classification no metastable V particles exist beyond those already known. The model is compatible with and somewhat favors the assumption of a high degree of symmetry between N and Ξ. Its general tenor is thus to emphasize the charge displacement $a = q - I_z$ as a physically significant parameter rather than the strangeness S. An unavoidable implication of the model is that all heavy particles have comparable interaction strengths, apparent exceptions being possible over limited energy ranges. The model provides a vehicle for study of the parity doublet scheme, which introduces greater complication in return for an added flexibility at present unnecessary in the model. (auth)

6985

CORRELATION ENERGY OF AN ELECTRON GAS AT HIGH DENSITY. Murray Gell-Mann (California Inst. of Tech., Pasadena) and Keith A. Brueckner (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 106, 364-8(1957) Apr. 15.

The quantity ϵ_c is defined as the correlation energy per particle of an electron gas expressed in rydbergs. It is a function of the conventional dimensionless parameter r_s, where r_s^{-3} is proportional to the electron density. Here ϵ_c is computed for small values of r_s (high density) and found to be given by $\epsilon_c = A \ln r_s + C + O(r_s)$. The value of A is found to be 0.0622, a result that could be deduced from previous work of Wigner, Macke, and Pines. An exact formula for the constant C is given here for the first time; earlier workers had made only approximate calculations of C. Further, it is shown how the next correction in r_s can be computed. The method is based on summing the most highly divergent terms of the perturbation series under the integral sign to give a convergent result. The summation is performed by a technique similar to Feynman's methods in field theory. (auth)

6986

CORRELATION ENERGY OF AN ELECTRON GAS AT HIGH DENSITY. Katuro Sawada (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 106, 372-83(1957) Apr. 15.

The correlation energy of an electron gas at high density is evaluated up to terms of orders $(r_s)^0$ and $\log r_s$. It is shown that the correlation energy to this order can be evaluated without using perturbation treatment. The result obtained coincides with the result of formal summation of apparently divergent series arising from small momentum transfer processes which has been discussed fully by Gell-Mann and Brueckner. The method to treat the small momentum transfer effect exactly is given by following the analogy of processes with well-known treatment of systems with Hamiltonians which are bilinear in creation and annihilation operators such as the neutral scalar pair theory. Some simple interpretations of the correlation energy to this order are also given. (auth)

6987

μ-MESON DECAY AND THE TWO-COMPONENT NEUTRINO. M. H. Friedman (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 106, 387-8(1957) Apr. 15.

It is proposed that the μ meson decays simultaneously into an electron plus two neutrinos or two antineutrinos. Giving up the conservation of light fermions in interactions involving two or more neutrinos, the two sets of interactions can be added to better fit the experimentally observed value for the Michel parameter and the back/front 0 to 10 Mev integrated asymmetry ratio. Additional terms for a previously considered interaction term are proposed. Theoretical values of the asymmetry parameter and back/front ratio are tabulated. (M.H.R.)

6988

VIOLATION OF PARITY CONSERVATION AND GENERAL RELATIVITY. E. C. G. Stueckelberg. Phys. Rev. 106, 388-9(1957) Apr. 15.

It is pointed out that a cosmological asymmetry is compatible with Riemannian space-time of ordinary general relativity. (M.H.R.)

6989

POSSIBLE TESTS OF TIME REVERSAL INVARIANCE IN BETA DECAY. J. D. Jackson, S. B. Treiman, and H. W. Wyld, Jr. (Princeton Univ., N. J.). Phys. Rev. 106, 517-21 (1957) May 1.

Noninvariance under space reflection and charge conjugation has now been established for beta decay processes. Invariance under time reversal remains an open question, however. Several possible tests for the validity of this symmetry operation are discussed. General expressions are given for the distribution function in three experimental situations, which have the possibility of detecting terms in allowed beta decay that are not invariant under time reversal: (a) experiments in which the nuclei are oriented and electron and neutrino momenta are measured; (b) experiments in which the nuclei are not oriented, but the recoil momentum and electron momentum and polarization are observed; (c) experiments in which the nuclei

are oriented and the electron momentum and polarization are measured. The distribution functions obtained omit Coulomb distortion effects and relativistic corrections for the nucleons, but are otherwise complete. Such experiments should permit, in addition to the detection of terms which are not invariant under time reversal, the beginnings of a determination of the ten complex coupling constants which now characterize beta decay. An additional somewhat surprising result is found. If the two-component neutrino theory of Lee and Yang is correct, and if certain perhaps reasonable assumptions concerning the relative magnitudes of the various coupling constants are valid, then the longitudinal polarization of electrons in allowed beta decay even from unoriented nuclei should be almost complete (specifically, equal to v/c). (auth)

6990

MEAN SQUARE RADIUS OF THE DEUTERON. J. S. Levinger and M. L. Rustgi (Louisiana State Univ., Baton Rouge). Phys. Rev. 106, 607(1957) May 1.

Values of parameters in expressions for neutron-proton potentials are briefly discussed. The relationship of these parameters to data from experiments on the deuteron photoeffect is shown. (B.J.H.)

URANIUM AND URANIUM COMPOUNDS

6991 BRB-34

Bridgeport Brass Co., Conn.

TRUE STRESS-STRAIN PROPERTIES OF NATURAL URANIUM. M. T. McGowan and R. M. Treco. Nov. 30, 1956. Decl. Feb. 15, 1957. 25p. Contract AT(30-1)-1405. $0.45(OTS).

The results of the tensile tests of the uranium are tabulated. The conventional stress-strain properties are listed including the 0.2% yield strength, ultimate tensile strength, Young's modulus, % reduction in area and % elongation. It appears that there is an orientation effect which is exerting an influence on the properties. The strength properties increase with cold work as is normally found. However, the reduction of area appears to increase to a peak at 71.7% reduction followed by a gradual decrease. At the maximum swage reduction of 96.9%, the reduction of area is still greater than that for the unworked material. The per cent elongation varies in the range of 11 to 19 to the 71.7% reduction, except for a low value of 8 at 22.7% reduction, followed by a gradual decline. The modulus increases and decreases during the lower swage reductions; however, it increases steadily at reductions of 58% and up. Some of the discrepancies which appear in the results may be due to tensile test errors. These would occur from faulty measurements of load and dimension. The presence of H would also account for some of the inconsistencies in the results. The original and worked structures of the material tested are shown. The change in the structure with different degrees of swaging is evident. (auth)

6992

THE THERMAL-NEUTRON ABSORPTION CROSS-SECTION OF U^{233}. T. S. Green, V. G. Small, and D. E. Glanville (A.E.R.E., Harwell). J. Nuclear Energy 1, 409-17(1957) Apr.

The ratio of the thermal-neutron absorption cross-sections of U^{233} and gold has been determined using a modification of the "Clinton oscillator." The cross-section of U^{233} was found to be 578 ± 17 barns, compared with gold taken as 98.6 barns. (auth)

PATENTS

CHEMISTRY

6993

TWO ROLLER ANTI-FRICTION LATCH. J. N. Young (to U. S. Atomic Energy Commission). U. S. Patent 2,780,112. February 5, 1957.

A releasable holding means of the latch type, comprising a cage and an even number of rollers moveably mounted in the cage and rolling on one another and on oppositely disposed surfaces of the cage is described. The cage is moved when a member acts on a roller surface. Operation of the latch is smooth with negligible friction between the moving parts. (auth)

6994

METHOD OF RECOVERING URANIUM FROM AQUEOUS SOLUTIONS. G. A. Lutz (to U. S. Atomic Energy Commission). U. S. Patent 2,780,514. February 5, 1957.

A method for recovering U values contained in dilute aqueous alkali carbonate solutions is described. This recovery is accomplished by contacting the solution with a strong-base quaternary amine anion exchange resin. The U values are absorbed on the resin, the resin is separated from the depleted solution, and the U eluted with a 6% NaOH–0.3% hydrogen peroxide reagent. (auth)

6995

METHOD FOR IMPROVED PRECIPITATION OF URANIUM PEROXIDE. A. J. Miller, B. M. Pitt and P. F. Grieger (to U. S. Atomic Energy Commission). U. S. Patent 2,780,515. February 5, 1957.

An improved method for the recovery of UO_4 from dilute aqueous solutions containing Fe is presented. The presence of Fe^{3+} in such solutions makes difficult the precipitation of UO_4 with H_2O_2. The Fe^{3+} catalytically decomposes the H_2O_2 precipitant, and also co-precipitates with the U, thus affecting the products' purity. The addition of malonate ion to the solutions, before the precipitation step, complexes the Fe^{3+} and prevents its decomposing the H_2O_2 and its precipitation with the U. The malonate is added as malonic acid and the pH of the solution is maintained between 1 and 3. (auth)

6996

CHEMICAL PURIFICATION OF URANIUM COMPOUNDS. J. C. Nevenzel (to U. S. Atomic Energy Commission). U. S. Patent 2,780,516. February 5, 1957.

A method of preparing U compounds of very high purity is described. This purity is achieved by using, in sequence, three separate purification steps. First an organic solvent extraction of $UO_2(NO_3)_2$ solution with diethyl ether is performed. The U is then extracted back into an aqueous phase and the second step, a UO_4 precipitation at low temperature is carried out. The UO_4 precipitate is heated and converted into UO_3 and this is dissolved in dilute H_2SO_4. The third step consists in adding acetone to this solution to precipitate a uranyl sulfate acetone complex. This precipitate may be heated to vaporize the acetone and obtain pure UO_2SO_4, or the precipitate may be calcined to uranium oxide. (auth)

6997

SEPARATION OF URANIUM FROM FOREIGN SUBSTANCES. B. J. Fontana (to U. S. Atomic Energy Commission). U. S. Patent 2,780,517. February 5, 1957.

A method for separating U from neutron irradiated Th is presented. The irradiated mass is dissolved in HNO_3 and a concentrated aqueous solution is formed wherein the $Th(NO_3)_4$ is present in a ratio by weight of $Th(NO_3)_4$ to H_2O of approximately 1:1. The U, however, is present in con-

centration of less then 1% that of the Th. This aqueous solution is then extracted with ether which preferentially takes up 70 to 80% of the U present and only 0.5% of the Th. (auth)

6998

PROCESS FOR RECOVERY OF URANIUM FROM AQUEOUS SOLUTIONS. J. W. Gates, Jr. and L. J. Andrews (to U. S. Atomic Energy Commission). U. S. Patent 2,780,518. February 5, 1957.

A method is described for the recovery of U from aqueous solutions in which the U is accompanied by F^- The method is particularly useful in connection with organic solvent extraction of U, and is effective in neutral or acidic solutions. It consists of incorporating Al^{3+} in the solution, in order to complex the F^- present. The Al concentration should preferably be sufficient to provide an atomic ratio of Al to F^-, of one to one. (auth)

6999

RECOVERY OF URANIUM FROM ORES. D. Kaufman and S. E. Bailey (to U. S. Atomic Energy Commission). U. S. Patent 2,780,519. February 5, 1957.

A process is described for recovering U from acid leach liquors containing high concentrations of silicates, Fe and Al and relatively little U. The recovery is effected by treating the leach liquors with a metallic reducing agent, e.g. Fe, to obtain the dissolved U as U^{4+}, and then adding a water soluble phosphate to effect the selective precipitation of uranous phosphate. This precipitate may then be treated with an alkali metal hydroxide to convert the uranous phosphate to uranous hydroxide. (auth)

7000

URANIUM SEPARATION PROCESS. R. M. Hainer and E. C. Evers (to U. S. Atomic Energy Commission). U. S. Patent 2,780,532. February 5, 1957.

A process is described for separating U from aqueous solutions in which it is accompanied by other metals, chiefly Fe, Ni and Cu. A dialkyl ether of a polyethylene glycol is used as an extracting agent after large quantities of NO_3^- have been added to the solution to affect salting out of $UO_2(NO_3)_2$. Under these conditions it has been found that the organic phase will extract approximately 98% of the U but will not extract appreciable amounts of any of the other metals present. $Ca(NO_3)_2$ and $NH_4(NO_3)$ are mentioned as being effective salting out agents. (auth)

7001

STILL COLUMN WITH CONCENTRIC CONDENSER. A. K. Brewer and T. I. Taylor (to U. S. Atomic Energy Commission). U. S. Patent 2,780,589. February 5, 1957.

A countercurrent reflux still is described which may be used in high vacuum or molecular distillation comprising an inclined still column in combination with an internal condensing and reflux device. The cooled side of the column is constructed as a series of inclined surfaces sloping in a direction opposite to the general direction of flow of liquid along the heated surface. Increased heat efficiency and greater temperature control of the heated and cooled surfaces are obtained with the disclosed still. (auth)

7002

ELECTRODEPOSITION OF URANIUM. H. A. Wilhelm and D. H. Ahmann (to U. S. Atomic Energy Commission). U. S. Patent 2,781,304. February 12, 1957.

A process for the electrodeposition of metallic U from fused uranium halide baths is given. It has been found that the U in the bath may be furnished by using an anode of UC_2. Alternatively the UC_2 may be placed in contact with, or adjacent to the anode whereby the UC_2 is broken down and the U dissolved. The electrolyte is a fused uranium alkali halide or a mixture of such halides. (auth)

7003

PROCESS OF RECOVERING URANIUM FROM SOLUTION. Robert Q. Boyer and Scott B. Kilner (to U. S. Atomic Energy Commission). U. S. Patent 2,781,303. February 12, 1957.

An electrolytic process is described for recovering U from calutron wash solutions in which it is accompanied by ionized Ni, Fe, Cr and Cu. The process employs a cell with an anode compartment, a cathode compartment, and a mercury cathode. An aqueous acid solution is the catholyte and the U containing solution is the anolyte. Upon electrolysis the U and other metallic ions migrate to the catholyte. The impurities are reduced and amalgamated with the mercury cathode while most of the U remains dissolved. The catholyte is continuously removed and the U recovered therefrom, and the depleted anolyte is continuously withdrawn, concentrated and recycled. (auth)

7004

URANIUM RECOVERY PROCESS. John J. Brunner (to U. S. Atomic Energy Commission). U. S. Patent 2,782,091. February 19, 1957.

A method is given for recovering U from the low U content hydroxide residues obtained from low grade ores. The recovery is accomplished by digesting the residues with H_2SO_4 at a pH of 3 to 3.8 and at a temperature of 68 to 100°C for at least an hour. The U is selectively extracted into solution by this digestion. The U is then precipitated from the acid solution by the addition of H_2O_2. (auth)

7005

RECOVERY OF METALS SALTS FROM MIXTURES. W. V. Wirth and D. X. Klein (to U. S. Atomic Energy Commission). U. S. Patent 2,782,092. February 19, 1957.

A method is presented for the separation of UF_6 from certain volatile halogenated hydrocarbons. The separation is accomplished by hydrolyzing the UF_6 to UO_2F_2 in an aqueous medium and then separating the water insoluble fluoro hydrocarbons therefrom by decanting or distillation. Since conducting the hydrolysis in an acid solution results in the formation of corrosive HF it is preferred to carry out the hydrolysis an alkaline or neutral medium. (auth)

7006

METHOD OF PREPARING METALS FROM THEIR HALIDES. F. H. Spedding, H. A. Wilhelm and W. H. Keller (to U. S. Atomic Energy Commission). U. S. Patent 2,782,116. February 19, 1957.

A method is given for the production of Th from its halides. The method consists in reducing ThF_4 by reaction with an alkali metal or alkali earth metal, particularly Ca. An additional feature is the admixture with the reaction mass of $ZnCl_2$. The $ZnCl_2$ is reduced by the Ca, and the Zn forms with the Th a metal mixture which melts below the melting point of the Th. The Zn can later be distilled away from the Th, allowing recovery of pure Th. (auth)

7007

METHOD OF RECLAIMING URANIUM. H. A. Wilhelm and C. F. Gray (to U. S. Atomic Energy Commission). U. S. Patent 2,782,117. February 19, 1957.

A method is given for reclaiming waste U filings, turnings and metal scrap. The scraps are sorted to separate large pieces of foreign matter and then cut up. During this cutting step a coolant liquid, 3% Na_2SiO_3, is provided which also acts as a degreasing and cleaning agent. The U pieces are then washed, sorted again and briquetted. The inclusion of about 0.1% of an alkali metal or alkali earth metal, for example Mg, to the briquetting mixture substantially improves the yield of U. (auth)

7008

SEPARATION OF URANIUM FROM OTHER METALS BY HYDRIDING. T. A. Butler (to U. S. Atomic Energy Com-

mission). U. S. Patent 2,785,046. March 12, 1957.

A method is given for separating U from other metals with which the U is alloyed. The method consists in selectively hydriding the U by contacting the alloy with H_2 at a temperature between 200° and 300°C and a pressure of from 3 to 150 millimeters. The unhydrided metal phase consisting mainly of Pu and either Sn, Au, Ag or Cu is then separated from the U by dissolution in a nonoxidizing mineral acid, e.g. 2N HCl. (auth)

7009

METHOD OF SEPARATING PLUTONIUM FROM CONTAMINANTS. H. S. Brown and O. F. Hill (to U. S. Atomic Energy Commission). U. S. Patent 2,785,047. March 12, 1957.

A method is presented for separating Pu from fission products, and for obtaining the Pu in a concentrated form. Irradiated U is dissolved in HNO_3, and a LaF_3 precipitate, which carries the Pu and the fluoride soluble fission products, is formed in the solution. The present invention comprises reacting this dried precipitate with HF whereby fission products which form relatively volatile fluorides are volatilized away from the Pu-containing LaF_3 mass. The mass is then treated with anhydrous F_2 at elevated temperatures whereby the Pu is oxidized and volatilized as its higher fluorides, and is thus separated from the LaF_3 and other less volatile constituents of the mass. (auth)

7010

BISMUTH PHOSPHATE PROCESS FOR THE SEPARATION OF PLUTONIUM FROM AQUEOUS SOLUTIONS. S. G. Thompson and G. T. Seaborg (to U. S. Atomic Energy Commission). U. S. Patent 2,785,951. March 19, 1957.

A method is given for separating Pu from fission products arising with it in the irradiated U. The method makes use of the fact that Pu^{6+} forms a soluble phosphate while lower valent plutonium forms an insoluble phosphate. The irradiated U is dissolved, Bi ion is added to serve as a carrier, and while the Pu is being maintained in its lower valent state, PO_4 is added, causing the precipitation of the Pu and any fission products which form insoluble phosphate. This precipitate is filtered out and then redissolved in an aqueous acid solution. The Pu is then oxidized to the higher valent state causing it to remain in solution when phosphate ion is added to precipitate out the phosphate insolubie fission products which accompanied the plutonium in the first precipitation. (auth)

7011

PREPARATION OF URANIUM METAL. C. H. Prescott, Jr., and J. A. Holmes (to U. S. Atomic Energy Commission). U. S. Patent 2,785,972. March 19, 1957

A method is given for production of high purity U by decomposing volatile UI_4 on a hot refractory surface. Iodine vapors are passed over solid UI_3 and the UI_4 thus formed is passed over a series of tungsten filaments heated to a temperature above 800°C but below the melting point of U. The UI_4 decomposes depositing pure U on the hot tungsten filaments. The process is carried out in a sealed and evacuated apparatus. (auth)

7012

PREPARATION OF FLAVONOID GLUCOSIDES. S. H. Wender and D. W. Fox (to U. S. Atomic Energy Commission). U. S. Patent 2,786,832. March 26, 1957.

A method is described for the preparation of flavonoid glucosides from their corresponding flavonoid rhamnoglucosides. This is accomplished by reacting formic acid with a solution of the flavonoid rhamnoglucoside in an aliphatic alcohol, particularly cyclohexanol. Temperature conditions are not critical although refluxing is usually satisfactory. The flavonoid glucoside reaction product is then recovered according to known methods. (auth)

ENGINEERING

7013

VACUUM GAUGE. G. A. Kuipers (to U. S. Atomic Energy Commission). U. S. Patent 2,780,099. February 5, 1957.

A vacuum measuring device comprising a vane pivotally mounted adjacent a wall within a test chamber is described. An opaque member attached to the vane generates a pulsating current in a photoelectric circuit. The current is supplied to a loop secured to the vane and acts with a magnet to maintain constant, the frequency of oscillation of the vane. The electrical power supplied to the loop is a measure of the pressure, due to the damping effect of the gas between the wall and vane. (auth)

7014

PUMP CYLINDER ASSEMBLY. J. Entwistle (to U. S. Atomic Energy Commission). U. S. Patent 2,782,081. February 19, 1957.

A pump cylinder assembly is described for use where considerable differential pressures exist on opposite sides of the sealing means. The assembly comprises a cylinder head, liner, and clamping means and is simpler in construction than the cylinder assembly using gaskets. A cylinder liner is clamped securely to a cylinder head. Mating ledges on a clamping ring and the liner act to tightly clamp the liner and cylinder head together. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

7015

METHOD OF SEPARATING URANIUM FROM ITS ORES. A. H. A. Ross, R. H. Farmer and A. G. W. Lamont (to U. S. Atomic Energy Commission). U. S. Patent 2,639,974. May 26, 1953.

A smelter process is described for obtaining a high content product from U ore concentrates, and is intended to replace the H_2SO_4 leaching of these concentrates. The process consists of fusing the U concentrates with lime and coke, whereby a slag is formed which contains substantially all of the U and which does not contain S, As or most of the various base metals present in the ore. Approximately 8 parts of coke and 30 parts of lime are used for every 500 parts of ore concentrates. The smelter product is soluble in HNO_3. (auth)

7016

URANIUM SEPARATION PROCESS. A. Thunaes, E. A. Brown, H. W. Smith and J. Brannen (to U. S. Atomic Energy Commission). U. S. Patent 2,738,253. March 13, 1956.

An acid leaching process for obtaining uranium from its low grade ores and complex ores is described. The ore is ground and agitated with a solution of $NaClO_3$ in weak H_2SO_4. The ClO_3^- is present to convert all U present to U^{6+} so that it will not be precipitated by PO_4^{3-} which is present in the ore. The process is carried out at a pH of less than 2.1. (auth)

7017

APPARATUS FOR VACUUM CASTING OF URANIUM. C. F. Gray and H. A. Wilhelm (to U. S. Atomic Energy Commission). U. S. Patent 2,782,475. February 26, 1957.

An improved apparatus for the vacuum casting of U slugs or biscuits is described. The apparatus consists of a mold, supporting, and joined to a crucible containing a melting chamber. The crucible and mold are connected by an aperture, the aperture is closed by a plug, and the plug is connected to a push rod adapted to move the plug and open the aperture from outside the apparatus. The assembly is covered by a shield resting on, and hermetically sealed to a

refractory base, allowing the production of a vacuum within the apparatus. An induction heating coil surrounds that portion of the apparatus containing the melting chamber. (auth)

7018

SEPARATION OF URANIUM FROM OTHER METALS BY HYDRIDING AND EXTRACTION WITH OXIDIZING REAGENTS. J. H. Carter and T. A. Butler (to U. S. Atomic Energy Commission). U. S. Patent 2,784,054. March 5, 1957.

A method is given for separating U from other metals with which the U is alloyed. The method consists in selectively hydriding the U by contacting the alloy with H_2 at a temperature between 200 and 300°C and a pressure of from 3 to 150 mm. The unhydrided metal phase consists mainly of Pu and either Sn, Au, Ag or Cu. The uranium hydride is separated from this phase by treatment with a solvent which selectively converts the uranium hydride to a soluble state. (auth)

7019

ZIRCONIUM TERNARY ALLOYS. L. L. Marsh, Jr. and W. Chubb (to U. S. Atomic Energy Commission). U. S. Patent 2,784,084. March 5, 1957.

A group of Zr–Nb ternary alloys are described which contain from 1% to 5% by weight of Nb and from 0.1% to 2% by weight of either Al, Mo or V. These alloys have low neutron capture cross sections, together with superior tensile characteristics at high temperatures and desirable ductility. Mentioned as outstanding in possessing these properties is the specific alloy containing 1.5% Nb and 1.0% Al, with the balance being Zr. (auth)

7020

METHOD OF FORMING CRUCIBLES AND REACTION CHAMBERS FOR PRODUCTION OF URANIUM OF HIGH PURITY. H. A. Wilhelm (to U. S. Atomic Energy Commission). U. S. Patent 2,785,064. March 12, 1957.

A method is given for forming a refractory lining for the reaction chamber or bomb in which alkali earth metal reduction of U halide is carried out. The method comprises inserting a form or mandrel into the chamber such that a uniform narrow space is left between the mandrel and chamber wall on all sides. This space is filled with anhydrous CaO powder. Instead of being tamped or compressed as it is added, the powder and reaction chamber are jolted until the powder has settled into a dense mass. (auth)

7021

METHOD OF PRODUCING METALS FROM THEIR HALIDES. F. H. Spedding, H. A. Wilhelm and W. H. Keller (to U. S. Atomic Energy Commission). U. S. Patent 2,785,065. March 12, 1957.

A method is given for the production of metallic Be from its halides. The method consists in reducing the Be halide, usually BeF_2, by reaction with an alkali metal or alkali earth metal preferably with a mixture of Ca and Mg. An additional feature, is the admixture, with the reaction mass, of some substance such as S, I_2 or an oxidizing salt, capable of an exothermic reaction with the reducing metal. This is done in order to develop a temperature higher than the melting point of the metal being produced. (auth)

PHYSICS

7022

COMBINATION OF ACCELERATION SENSING AND INTEGRATING MEANS. H. F. Devaney (to U. S. Atomic Energy Commission). U. S. Patent 2,780,455. February 5, 1957.

A device combining acceleration sensing and integrating means in a rugged and reliable construction is described. A hair spring connected to a shaft with an acceleration responsive balance member controls the oscillation frequency of an escapement member, to thereby control movement of a train of gears. An output wheel with electrical contact means is geared to the train so that a change in acceleration varies the time before an electrical circuit is closed. (auth)

7023

TEST EXPONENTIAL PILE. Enrico Fermi (to U. S. Atomic Energy Commission). U. S. Patent 2,780,595. February 5, 1957.

A nuclear fission test pile is described which is designed to measure the fissioning chain reaction induced in a subcritical mass of natural U by a neutron source. The pile comprises a number of cells containing natural U, disposed in a graphite moderator, and adjacent to an independent source of neutrons for the purpose of causing in the test pile a chain reaction that cannot be self-sustaining. Measurements are made of the radioactivity induced in strips of indium foil which are inserted in appropriate slots or channels in the core. This pile permits the taking of such measurements from a reactor requiring a reduced amount of valuable material, and eliminates the possibility of a dangerous buildup of reactivity. (auth)

7024

NEUTRONIC REACTOR. G. A. Anderson (to U. S. Atomic Energy Commission). U. S. Patent 2,780,596. February 5, 1957.

The design structure is given for a reactor core incorporating hexagonal fuel channels, in which fuel plates, supported and separated by frames, are inserted. A metallic Be reflector is situated about the core to intensify the neutron density within the contained space. Breeding channels are also contained in the reflector so that further material such as Th may be converted into a fissionable U isotope. The fuel and cooling channels are designed so that a maximum of heat may be extracted for conversion into power. This reactor design therefore combines an efficient production of useful heat with the facility for breeding fissionable U from Th. (auth)

7025

APPARATUS FOR THE MEASUREMENT OF NEUTRON ABSORPTION. E. P. Wigner (to U. S. Atomic Energy Commission). U. S. Patent 2,781,307. February 12, 1957.

An apparatus designed to measure the unknown neutron absorptive properties of a substance is described. This is accomplished by the cyclic insertion and removal of the sample substance from a reactor core. The power level of the reactor varies with the same frequency as the positioning of the sample relative to the core. The fluctuation of the power level can be measured by suitable means such as an ionization chamber, which is then compared with the fluctuation caused by the positioning of a sample with known neutron absorptive properties, and a comparison or relative measurement of the unknown properties may be determined. (auth)

7026

NEUTRONIC REACTOR CONTROL. E. C. Creutz and W. H. Zinn (to U. S. Atomic Energy Commission). U. S. Patent 2,781,308. February 12, 1957.

A reactor control system comprising tubular control rods is described. The tubular rods contain a material having a danger coefficient of at least 100 enclosed in inner and outer protective tubes of a material having a danger coefficient less than 10. (auth)

7027

RADIATION SYSTEM. J. S. Levinger et al. (to U. S. Atomic Energy Commission). U. S. Patent 2,781,309. February 12, 1957.

An apparatus is described for utilizing as a neutron source the delayed neutron obtained in fission at places remote from a primary source of neutrons. A section of a closed fluid circulating system containing fissionable material is bombarded by neutrons at one point in this circuit. The delayed fission neutrons are then used at another point in the system. (auth)

7028

GATING CIRCUIT. W. C. Struven (to U. S. Atomic Energy Commission). U. S. Patent 2,781,448. February 12, 1957.

A gating circuit utilizing two vacuum tubes and a pair of crystal diodes is described. A gating signal applied to the control grid of each tube concurrently with input signals varies the potential of the output terminal of the circuit in proportion to the input signal, within the limits of the gating signal. (auth)

7029

ION BEAM RECEIVER. E. J. Lofgren and F. Fairbrother (to U. S. Atomic Energy Commission). U. S. Patent 2,781,452. February 12, 1957.

A probe is described which is used to ascertain the electrical current value of an accelerated particle beam independent of the usual current influencing factors, such as secondary charge on the probe. The power absorbed by the collector cup is determined by measuring the electrical power required to heat the collector cup to the temperature assumed when the beam impinges. Beam current is computed using the electrical power absorbed and the accelerating potential in the electrical power equation. (auth)

7030

NEUTRONIC REACTOR. J. A. Wheeler (to U. S. Atomic Energy Commission). U. S. Patent 2,782,158. February 19, 1957.

The structural arrangement of the core for a nuclear reactor with improved cooling and heat extraction is described. A graphite tube containing reactor fuel is seated in an opening through a stack of several graphite bricks, each opening having oppositely disposed side cut-outs. Slits through the tube provide gas passages to and from the fuel elements within the tube. The coolant passes through one cut-out passage to the tube center by way of the slits, and is removed from the core via an opposite tube slit and the other cut-out passage. Constriction of the intake cut-out passage and appropriate slit positioning are ways of varying the heat absorbed along the length of the fuel tube. (auth)

7031

FOLLOW-UP MECHANISM. H. V. Lichtenberger and L. J. Koch (to U. S. Atomic Energy Commission). U. S. Patent 2,782,941. February 26, 1957.

An apparatus is described for withdrawing a control rod from a reactor core and reinserting it without the rod sticking or becoming jammed as it returns. An improved electromagnet, when energized, locks to a magnetic head on the control rod. A motor through a rack and pinion assembly lifts the control rod from the core. Insertion of the control rod is effected by de-energizing the magnet, dropping the rod. The control rod is driven positively into the core by the motor when a switch tripped by the falling control rod reverses the motor. (auth)

7032

PRESSURE SWITCH. A. F. Fink (to U. S. Atomic Energy Commission). U. S. Patent 2,783,320. February 26, 1957.

An instrument is described for indicating the occurrence of an overpressure. Two conducting domes are mounted concentrically and spaced from one another so that a pressure sufficient to crush the outer dome will cause it to make contact with the inner dome, thus closing an electric circuit connected between the two domes. The novel pressure indicator responds to the positive application of pressure, not to the stresses created in the member to which it is secured. (auth)

7033

AUTOMATIC CONTROL SYSTEM WITH REMOTE ADJUSTMENT. W. H. Appleton and G. M. Farly (to U. S. Atomic Energy Commission). U. S. Patent 2,782,993. February 26, 1957.

An apparatus for remote control and adjustment of an automatic temperature system is described. A manually adjustable resistance located at a remote point is arranged to unbalance a bridge circuit. The difference between the selected temperature and the temperature within the heated area is indicated on a calibrated voltmeter at the remote point. (auth)

7034

HIGH SPEED POSITIVE PULSE GENERATOR. W. A. Ha... (to U. S. Atomic Energy Commission). U. S. Patent 2,783,376. February 26, 1957.

An improved pulse generating circuit for exciting a Ker... cell employed as a shutter on a high-speed camera is described. The novel feature of the circuit is the use of two control bias tubes to provide a low impedance return circuit for the control grids of a parallel triggered blocking oscillator, while allowing high resistance direct current paths for biasing potentials. Output pulses of substantial amplitude with a base width of less than one microsecond and internal spacing of the order of microseconds are obtained with this circuit. (auth)

7035

REGULATED POWER SUPPLY. W. R. Baker (to U. S. Atomic Energy Commission). U. S. Patent 2,783,433. February 26, 1957.

An improved voltage regulated power supply is described which provides a d-c output voltage substantially independent of frequency and wave shape, or of change in the characteristics of the supply components. A voltage dividing network across the output terminals of a d-c supply comprises two resistors in series connected between the terminals with a capacitor in parallel with each resistor, the time constant of each RC combination being the same. A fraction of the output voltage is obtained from the divider and controls the voltage amplitude of a rectified radio frequency signal. This voltage adjusts the drop across a conventional series voltage regulator tube. (auth)

7036

GAS RECOVERY SYSTEM. John Ise, Jr., and George P. Millburn (to U. S. Atomic Energy Commission). U. S. Patent 2,784,799. March 12, 1957.

A gas recirculation system is described in which a valuable isotope, exhausted from a cyclotron diffusion pump is recompressed and piped through a filter which removes all substances foreign to the desired isotope. The purified gas is further recompressed and recirculated to the ion source where the isotope is reionized and reaccelerated. This recirculation system will permit the recovery and reuse of an otherwise prohibitively expensive material. (auth)

7037

PULSE HEIGHT ANALYZER. A. E. Larsh, Jr. and A. Ghiorso (to U. S. Atomic Energy Commission). U. S. Patent 2,784,910. March 12, 1957.

A multi-channel differential pulse height analyzer is described for sorting pulses from a radiation detector ac-

cording to the magnitudes thereof. A plurality of pulse channels receive pulses from a single source. Each channel has a multivibrator section which responds to a different pulse amplitude, and in turn operates an electromechanical register. Operation of only the channel corresponding to the maximum value of the input pulse is accomplished by blocking the channels responsive to lesser amplitudes. (auth)

7038

LOW VOLTAGE ION SOURCE. E. O. Lawrence (to U. S. Atomic Energy Commission). U. S. Patent 2,785,311. March 12, 1957.

An improved generator is described for the production of a very high current ion beam. Electrons emitted from a cathode are directed by a magnetic field into a region of an arc discharge, where they bombard gas molecules. Ions formed in the region are drawn out by means of several negatively charged electrodes. The electrodes are curved and nested in parallel relationship and have apertures aligned to form a narrow high current ion beam from the several low current beams passing through electrodes. (auth)

7039

SOURCE UNIT FOR PRODUCING IONIZED GAS. L. Ruby, R. B. Crawford and W. Pon (to U. S. Atomic Energy Commission). U. S. Patent 2,786,143. March 19, 1957.

A device is described for producing a space charge neutralized ion cloud which can be repetitiously operated, eliminates the use of an external gas supply, and results in negligible coincident contamination by neutral gas molecules or associated electron beams. The source unit comprises a plurality of interleaved occluded-gas metallic discs and insulating spacers. The neutral ion cloud is generated by establishing an electrical arc discharge between the peripheral surfaces of the metallic discs for a specific interval. (auth)

NUCLEAR SCIENCE ABSTRACTS

Volume 11 July 31, 1957 No. 14

GENERAL

ATOMIC BOMBS AND WARFARE

7040 WT-1169
Division of Biology and Medicine, AEC and Los Alamos Scientific Lab., N. Mex.
TECHNICAL PHOTOGRAPHY, DOCUMENTARY. S. A. Anthony and Robert Crook. June 1956. 34p. Project 39.4a [of] OPERATION TEAPOT. $0.30(OTS).
Procedures were developed for the more effective utilization of men, equipment, and available time to meet the requirements of project officers for documentary photographs during Teapot Operation. These procedures are discussed and illustrated. (C.H.)

7041 AEC-tr-2922
ATOMIC WEAPON. V. A. Mesentsev. Translation of Chap. III, p.74-107 in The Atom and Atomic Energy (Atom I Atomnaya Energiya). Military Publishing House, Ministry of Defense, U.S.S.R., (Moscow), 1955. 36p. (F-TS-8777/V).

7042
SEISMOLOGICAL AND RELATED ASPECTS OF THE 1954 HYDROGEN BOMB EXPLOSIONS. T. N. Burke-Gaffney (Riverview Coll. Observatory, N. S. W.) and K. E. Bullen (Univ. of Sidney). Australian J. Phys. 10, 130-6(1957) Mar.
Seismic data, recorded in the regular way, from four American hydrogen bomb explosions of 1954, indicate that the origin-times of the explosions were, in G.M.T.: (i) Feb. 28 days 18 hr 45 min 0 sec, (ii) Mar. 26 days 18 hr 30 min 0 sec, (iii) Apr. 25 days 18 hr 10 min 0 sec, (iv) May 4 days 18 hr 10 min 0 sec. If these surmised times are correct, and if the assumed source-point is correct, the results show that the seismic travel-times from Bikini in all azimuths need reductions of the order of 1–2 sec (possibly more) from the standard travel-times. The analysis focuses attention on the great value atomic explosions can have in advancing knowledge of the Earth's interior when precise details of origin-times and source-points are released. The analysis is also applied to observations by Yamamoto of air waves from the explosions. It is shown that there is no seasonal effect on the mean air velocities as suggested by Yamamoto. Also discrepancies which appeared in Yamamoto's work between the velocities for these shocks on the one hand, and the Krakatoa eruption of 1883 and the fall of the Siberian meteor of 1908 on the other hand, are removed. (auth)

Refer also to abstract 7065.

ATOMIC POWER

7043 AERE-Inf/Bib-97(2nd. ed.)
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE UNITED KINGDOM ATOMIC POWER PROGRAMME. A SELECTED READING LIST. Mar. 1957. 5p.
A first revision of AERE-Inf/Bib-97 issued in March 1956.

7044
THERMONUCLEAR POWER: A THEORETICAL INTRODUCTION. W. B. Thompson (Atomic Energy Research Establishment, Harwell, Berks). Nature 179, 886-9(1957) May 4.

RESEARCH PROGRAMS

7045 BNL-426
Brookhaven National Lab., Upton, N. Y.
ANNUAL REPORT — JULY 1, 1956. 150p. Contract AT-30-2-GEN-16. $0.75(OTS).
The progress and trends of the research program of the Brookhaven National Laboratory are presented along with a description of the operational, service, and administrative activities. The activities of the laboratory service organization are reported in detail whereas research activities are covered only in summary, since the details are covered more fully in scientific and technical periodicals and reports. (For previous report see BNL-364.) (M.H.R.)

BIOLOGY AND MEDICINE

7046 HW-43060
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
NO_2 EXPOSURES FROM OPERATIONS IN THE 224 U BUILDING. W. E. Gill. May 15, 1956. 12p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).
The problem of air contamination by NO_2, HNO_3, and UO_3 from the calcination pots in building 224 U is surveyed. The recommendations for remedying the situation are given. (T.R.H.)

7047
SOME DISTANCE EFFECTS PRODUCED BY A PHOTODYNAMIC SHOCK ON SMALL LABORATORY ANIMALS. Frederic Ludwig. Intern. J. Appl. Radiation Isotopes 2, 44-51(1957) Apr.

RADIATION EFFECTS

7048 AFPTRC-TN-57-19
Personnel and Training Research Center. Personnel Lab., Lackland AFB, Tex.
METHODS OF REDUCTION OF PSYCHOLOGICAL STRESS DUE TO RADIATION. Robert G. Smith, Jr. and John A. Cox, Jr. Feb. 4, 1957. 14p. Project 7734. (AD-098922).

7049
COMPARATIVE BIOLOGIC EFFECT OF 30 MeV_p AND 220 kV_p ROENTGEN RAYS AND 0.4 MeV GAMMA RAYS AT 8–9°C. K. C. Bora (Indian Cancer Research Centre, Bombay). Acta Radiol. 47, 321-6(1957) Apr.

7050
MODIFICATION OF THE RELEASE OF CELLULAR CONSTITUENTS BY IRRADIATED ESCHERICHIA COLI. Daniel Billen (Oak Ridge National Lab., Tenn.). Arch. Biochem. Biophys. 67, 333-40(1957) Apr.

7051
PULMONARY EFFECTS FROM RADIOACTIVE THALLIUM-ACTIVATED CLAY PARTICLES. H. Cember, J. A. Watson, and T. B. Grucci. Arch. Ind. Health 15, 449-50 (1957) May.

The structure of quartz and vitreous silica disordered by heavy irradiation (10^{20} neutrons per $cm.^2$) of fast neutrons was studied by means of x-ray-diffraction and infrared spectroscopy. The results indicate that the structure of the disordered amorphous form of silica resembles closely that of vitreous silica. The average Si–O distance (1.61 a.u.) remains unchanged, but the average Si–O–Si bond angle decreases from 142° to 138°; the radial distances of the more distant neighbor atoms show a wider distribution in the disordered material. It is suggested that the disordered form of silica results from thermal effects (thermal spikes) accompanying the passage of knocked-on atoms through the solid. (auth)

6974

METHOD OF OBTAINING DERIVATIVE SPECTRA. J. Paul Pemsler (Goodyear Atomic Corp., Portsmouth, Ohio). Rev. Sci. Instr. 28, 274-5(1957) Apr.

The first derivative with respect to wavelength of the transmission curve has been used to detect overlapping spectral bands. The commercially available Perkin-Elmer Model 13 Ratio Recording Spectrophotometer may be easily adapted to record directly the derivative spectrum throughout the ultraviolet, visible, and infrared regions. (auth)

THEORETICAL PHYSICS

6975 AECU-3459

RAND Corp., Santa Monica, Calif.

THOMAS-FERMI EQUATION OF STATE FOR DILUTE GASES. Richard Latter. Jan. 3, 1957. 22p. For Univ. of Calif. Radiation Lab. Contract [W-7405-eng-48], Subcontract SC-101. (RM-1847-AEC; AD-123511). $7.80(ph OTS); $3.30(mf OTS).

The electronic component of the equation of state of very dilute gases has been obtained using the Thomas-Fermi model and following the methods described in RAND report RM-1227-AEC. Curves of $P/Z^{10/3}$ vs. ZV at constants $kT/Z^{4/3}$ and S/Zk and $(E_T - E_T^*)/Z^{7/3}$ vs. ZV at constant $kT/Z^{4/3}$ are shown in the following graphs. The data cover the regions $10^{-14} cm^3 \geq ZV \geq 10^{-19} cm^3$ for 10^{12} dynes/$cm^2 \geq P/Z^{10/3} \geq 10^{-3}$ dynes/cm^2 and $10^{-19} cm^3 \geq ZV \geq 10^{-22} cm^3$ for 10^3 dynes/$cm^2 \geq P/Z^{10/3} \geq 10^{-3}$ dynes/cm^2. (auth)

6976

ON THE THEORY OF LIQUIDS. Louis Goldstein (Los Alamos Scientific Lab., N. Mex.). Ann. Phys. 1, 33-57 (1957) Apr.

The present paper concerns the exact analytic forms of correlation functions of liquids and some of their macroscopic properties which these correlations determine. Since these functions are expressible in terms of the scattering structure factors of liquids, the macroscopic properties they define will be described in terms of the properties of the structure factors. One is then led, with some limitations, to a rigorous result on the behavior of pair potential energies of isolated stationary atoms at close separations. Part of the paper is devoted to a discussion of some of the limitations of the experimentally derived structure factors as well as the liquid correlation functions to which they give rise. It will be shown, on the basis of liquid helium data, that improvements in the empirical correlation functions as well as the various macroscopic liquid properties they define, require the knowledge of the structure factors over a far wider range of the momentum changes on scattering than obtained heretofore. The final topic concerns a detailed study of the asymptotic, large atomic separation, behavior of the correlation functions. The temperature limitations of a direct method yielding these asymptotic forms will be obtained. A new method of derivation of these forms, involving the scattering structure factors, will be described. This same method also leads to the asymptotic form of the structure factors themselves, at large values of the momentum changes on scattering. These latter asymptotic structure factors retain their validity over the whole temperature interval of existence of liquids. (auth)

6977

ELECTROMAGNETIC PROPERTIES OF NUCLEONS AND BARION-HEAVY MESON INTERACTIONS. B. Vitale. Nuovo cimento (10) 5, 732-6(1957) Mar.

6978

ON THE CONSERVATION OF NUCLEONS. B. Ferretti (CERN, Genève). Nuovo cimento (10) 5, 761(1957) Mar.

6979

ENERGY DEPENDENCE OF CROSS SECTIONS NEAR THRESHOLD: NEUTRAL PARTICLES. William H. Guier and Robert W. Hart (Johns Hopkins Univ., Silver Spring, Md.). Phys. Rev. 106, 296-9(1957) Arp. 15.

A procedure is developed for determining the excess-energy dependence near threshold of reaction cross sections involving the escape of an arbitrary number of neutral particles. It is somewhat analogous to Wigner's procedure in that only an asymptotic solution of Schrödinger's equation is used, but is more readily applied to many-particle escape because it does not require the explicit matching of this solution at a reaction zone boundary. Explicit samples include the escape of two identical particles with arbitrary angular momentum, and the escape of an arbitrary number of identical particles with zero angular momentum. (auth)

6980

RELATIVISTIC CORRECTIONS TO p-p SCATTERING. G. Breit (Yale Univ., New Haven, Conn.). Phys. Rev. 106, 314-20(1957) Apr. 15.

Effects of wave function distortion by nuclear forces of nonelectromagnetic origin are qualitatively considered. It is found that the relativistic corrections to the Coulomb wave contain effects of wave function distortion which may affect these corrections by reasonably large fractional amounts. The spin-orbit interactions arising from the action of the electric field are found to be affected by wave function distortion. Since these interactions affect the polarization of proton beams in double and triple scattering, the analysis of high-energy data is affected. The theory of spin-orbit interactions is brought into relation with that of atomic spectra. The unreliability of contact terms contained in the relativistic corrections is brought out. A concise proof of the vanishing of first-order tensor force effects on the polarization applying independently of the origin of the tensor force effects is supplied in an appendix. (auth)

6981

REMARKS ON POSSIBLE NONINVARIANCE UNDER TIME REVERSAL AND CHARGE CONJUGATION. T. D. Lee (Columbia Univ., New York) and Reinhard Oehme and C. N. Yang (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 106, 340-5(1957) Apr. 15.

Interrelations between the nonconservation properties of parity, time reversal, and charge conjugation are discussed. The results are stated in two theorems. The experimental implications for the $K-\bar{K}$ complex are discussed in the last section. (auth)

6982

FERMI DECAY OF HIGHER SPIN PARTICLES. R. E. Behrends and C. Fronsdal (Univ. of California, Los Angeles). Phys. Rev. 106, 345-53(1957) Apr. 15.

The explicit form for the spin projection operators introduced by Fronsdal is calculated for arbitrary spin and applied to first-order processes involving four fermions.

The matrix element for the most general nonderivative interaction is found for the special case in which two of the particles have spin ½. The method of relating matrix elements written in different orders is extended to this case. The theory is applied to the decay of the mu meson, extending the work of Caianiello. It is found that the experimental decay spectrum can be equally well fitted by an assignment of spin ½ or ³⁄₂. The method is then applied to the Fermi decay of hyperons. Lifetimes are calculated for decays in which the initial particle has a spin of ½ or ³⁄₂, and the final particles all have spin ½. All the lifetimes are less than 2 orders of magnitude longer than the corresponding observed lifetimes for the normal mode of decay. The hypothesis of a universal Fermi interaction is extended to include fermions of arbitary spin. Under this hypothesis, the experimental muon spectrum is most closely reproduced with spin ³⁄₂. The results also indicate that the muon has the same particle-antiparticle character as an electron of the same charge. (auth)

6983

PARITY DOUBLETS AND HYPERFRAGMENT BINDING. Laurie M. Brown (Northwestern Univ., Evanston, Ill.). Phys. Rev. 106, 354-7(1957) Apr. 15.

The Thomas variation-iteration method is applied to a model of a hypernucleus in which the binding arises from a potential which mixes orbital states of opposite parity, a situation which may prevail if the Λ^* has the parity doublet structure suggested by Lee and Yang. The P-state part of the ground state increases with the mass of the hyperfragment and may have a probability as large as 20% for mass number 8, with correspondingly large effect upon the decay rate of the fragment and upon the ratio of mesonic to nonmesonic decay. (auth)

6984

COMPOUND MODEL FOR HEAVY PARTICLES. R. W. King (Purdue Univ., Lafayette, Ind.) and D. C. Peaslee (Univ. of California, Berkeley). Phys. Rev. 106, 360-3 (1957) Apr. 15.

A static model is considered in which all heavy particles are compounded out of two basic units, taken here to be the Λ and nucleon N (and/or the cascade particle Ξ). The model suggests the existence of some unstable particle states accessible to experiment: the ρ meson, a boson with I = 0; the Λ^{**}, a highly excited I = 0 state of the Λ; the Z hyperon unstable against rapid decay by Z → K + N. Without artificial assumption the model directly indicates that in the present strangeness classification no metastable V particles exist beyond those already known. The model is compatible with and somewhat favors the assumption of a high degree of symmetry between N and Ξ. Its general tenor is thus to emphasize the charge displacement $a = q - I_z$ as a physically significant parameter rather than the strangeness S. An unavoidable implication of the model is that all heavy particles have comparable interaction strengths, apparent exceptions being possible over limited energy ranges. The model provides a vehicle for study of the parity doublet scheme, which introduces greater complication in return for an added flexibility at present unnecessary in the model. (auth)

6985

CORRELATION ENERGY OF AN ELECTRON GAS AT HIGH DENSITY. Murray Gell-Mann (California Inst. of Tech., Pasadena) and Keith A. Brueckner (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 106, 364-8(1957) Apr. 15.

The quantity ϵ_c is defined as the correlation energy per particle of an electron gas expressed in rydbergs. It is a function of the conventional dimensionless parameter r_s, where r_s^{-3} is proportional to the electron density. Here ϵ_c is computed for small values of r_s (high density) and found to be given by $\epsilon_c = A \ln r_s + C + O(r_s)$. The value of A is found to be 0.0622, a result that could be deduced from previous work of Wigner, Macke, and Pines. An exact formula for the constant C is given here for the first time; earlier workers had made only approximate calculations of C. Further, it is shown how the next correction in r_s can be computed. The method is based on summing the most highly divergent terms of the perturbation series under the integral sign to give a convergent result. The summation is performed by a technique similar to Feynman's methods in field theory. (auth)

6986

CORRELATION ENERGY OF AN ELECTRON GAS AT HIGH DENSITY. Katuro Sawada (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 106, 372-83(1957) Apr. 15.

The correlation energy of an electron gas at high density is evaluated up to terms of orders $(r_s)^0$ and $\log r_s$. It is shown that the correlation energy to this order can be evaluated without using perturbation treatment. The result obtained coincides with the result of formal summation of apparently divergent series arising from small momentum transfer processes which has been discussed fully by Gell-Mann and Brueckner. The method to treat the small momentum transfer effect exactly is given by following the analogy of processes with well-known treatment of systems with Hamiltonians which are bilinear in creation and annihilation operators such as the neutral scalar pair theory. Some simple interpretations of the correlation energy to this order are also given. (auth)

6987

μ-MESON DECAY AND THE TWO-COMPONENT NEUTRINO. M. H. Friedman (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 106, 387-8(1957) Apr. 15.

It is proposed that the μ meson decays simultaneously into an electron plus two neutrinos or two antineutrinos. Giving up the conservation of light fermions in interactions involving two or more neutrinos, the two sets of interactions can be added to better fit the experimentally observed value for the Michel parameter and the back/front 0 to 10 Mev integrated asymmetry ratio. Additional terms for a previously considered interaction term are proposed. Theoretical values of the asymmetry parameter and back/front ratio are tabulated. (M.H.R.)

6988

VIOLATION OF PARITY CONSERVATION AND GENERAL RELATIVITY. E. C. G. Stueckelberg. Phys. Rev. 106, 388-9(1957) Apr. 15.

It is pointed out that a cosmological asymmetry is compatible with Riemannian space-time of ordinary general relativity. (M.H.R.)

6989

POSSIBLE TESTS OF TIME REVERSAL INVARIANCE IN BETA DECAY. J. D. Jackson, S. B. Treiman, and H. W. Wyld, Jr. (Princeton Univ., N. J.). Phys. Rev. 106, 517-21 (1957) May 1.

Noninvariance under space reflection and charge conjugation has now been established for beta decay processes. Invariance under time reversal remains an open question, however. Several possible tests for the validity of this symmetry operation are discussed. General expressions are given for the distribution function in three experimental situations, which have the possibility of detecting terms in allowed beta decay that are not invariant under time reversal: (a) experiments in which the nuclei are oriented and electron and neutrino momenta are measured; (b) experiments in which the nuclei are not oriented, but the recoil momentum and electron momentum and polarization are observed; (c) experiments in which the nuclei

are oriented and the electron momentum and polarization are measured. The distribution functions obtained omit Coulomb distortion effects and relativistic corrections for the nucleons, but are otherwise complete. Such experiments should permit, in addition to the detection of terms which are not invariant under time reversal, the beginnings of a determination of the ten complex coupling constants which now characterize beta decay. An additional somewhat surprising result is found. If the two-component neutrino theory of Lee and Yang is correct, and if certain perhaps reasonable assumptions concerning the relative magnitudes of the various coupling constants are valid, then the longitudinal polarization of electrons in allowed beta decay even from unoriented nuclei should be almost complete (specifically, equal to v/c). (auth)

6990

MEAN SQUARE RADIUS OF THE DEUTERON. J. S. Levinger and M. L. Rustgi (Louisiana State Univ., Baton Rouge). Phys. Rev. 106, 607(1957) May 1.

Values of parameters in expressions for neutron-proton potentials are briefly discussed. The relationship of these parameters to data from experiments on the deuteron photoeffect is shown. (B.J.H.)

URANIUM AND URANIUM COMPOUNDS

6991 BRB-34

Bridgeport Brass Co., Conn.

TRUE STRESS-STRAIN PROPERTIES OF NATURAL URANIUM. M. T. McGowan and R. M. Treco. Nov. 30, 1956. Decl. Feb. 15, 1957. 25p. Contract AT(30-1)-1405. $0.45(OTS).

The results of the tensile tests of the uranium are tabulated. The conventional stress-strain properties are listed including the 0.2% yield strength, ultimate tensile strength, Young's modulus, % reduction in area and % elongation. It appears that there is an orientation effect which is exerting an influence on the properties. The strength properties increase with cold work as is normally found. However, the reduction of area appears to increase to a peak at 71.7% reduction followed by a gradual decrease. At the maximum swage reduction of 96.9%, the reduction of area is still greater than that for the unworked material. The per cent elongation varies in the range of 11 to 19 to the 71.7% reduction, except for a low value of 8 at 22.7% reduction, followed by a gradual decline. The modulus increases and decreases during the lower swage reductions; however, it increases steadily at reductions of 58% and up. Some of the discrepancies which appear in the results may be due to tensile test errors. These would occur from faulty measurements of load and dimension. The presence of H would also account for some of the inconsistencies in the results. The original and worked structures of the material tested are shown. The change in the structure with different degrees of swaging is evident. (auth)

6992

THE THERMAL-NEUTRON ABSORPTION CROSS-SECTION OF U^{233}. T. S. Green, V. G. Small, and D. E. Glanville (A.E.R.E., Harwell). J. Nuclear Energy 1, 409-17(1957) Apr.

The ratio of the thermal-neutron absorption cross-sections of U^{233} and gold has been determined using a modification of the "Clinton oscillator." The cross-section of U^{233} was found to be 578 ± 17 barns, compared with gold taken as 98.6 barns. (auth)

PATENTS

CHEMISTRY

6993

TWO ROLLER ANTI-FRICTION LATCH. J. N. Young (to U. S. Atomic Energy Commission). U. S. Patent 2,780,112. February 5, 1957.

A releasable holding means of the latch type, comprising a cage and an even number of rollers moveably mounted in the cage and rolling on one another and on oppositely disposed surfaces of the cage is described. The cage is moved when a member acts on a roller surface. Operation of the latch is smooth with negligible friction between the moving parts. (auth)

6994

METHOD OF RECOVERING URANIUM FROM AQUEOUS SOLUTIONS. G. A. Lutz (to U. S. Atomic Energy Commission). U. S. Patent 2,780,514. February 5, 1957.

A method for recovering U values contained in dilute aqueous alkali carbonate solutions is described. This recovery is accomplished by contacting the solution with a strong-base quaternary amine anion exchange resin. The U values are absorbed on the resin, the resin is separated from the depleted solution, and the U eluted with a 6% NaOH–0.3% hydrogen peroxide reagent. (auth)

6995

METHOD FOR IMPROVED PRECIPITATION OF URANIUM PEROXIDE. A. J. Miller, B. M. Pitt and P. F. Grieger (to U. S. Atomic Energy Commission). U. S. Patent 2,780,515. February 5, 1957.

An improved method for the recovery of UO_4 from dilute aqueous solutions containing Fe is presented. The presence of Fe^{3+} in such solutions makes difficult the precipitation of UO_4 with H_2O_2. The Fe^{3+} catalytically decomposes the H_2O_2 precipitant, and also co-precipitates with the U, thus affecting the products' purity. The addition of malonate ion to the solutions, before the precipitation step, complexes the Fe^{3+} and prevents its decomposing the H_2O_2 and its precipitation with the U. The malonate is added as malonic acid and the pH of the solution is maintained between 1 and 3. (auth)

6996

CHEMICAL PURIFICATION OF URANIUM COMPOUNDS. J. C. Nevenzel (to U. S. Atomic Energy Commission). U. S. Patent 2,780,516. February 5, 1957.

A method of preparing U compounds of very high purity is described. This purity is achieved by using, in sequence, three separate purification steps. First an organic solvent extraction of $UO_2(NO_3)_2$ solution with diethyl ether is performed. The U is then extracted back into an aqueous phase and the second step, a UO_4 precipitation at low temperature is carried out. The UO_4 precipitate is heated and converted into UO_3 and this is dissolved in dilute H_2SO_4. The third step consists in adding acetone to this solution to precipitate a uranyl sulfate acetone complex. This precipitate may be heated to vaporize the acetone and obtain pure UO_2SO_4, or the precipitate may be calcined to uranium oxide. (auth)

6997

SEPARATION OF URANIUM FROM FOREIGN SUBSTANCES. B. J. Fontana (to U. S. Atomic Energy Commission). U. S. Patent 2,780,517. February 5, 1957.

A method for separating U from neutron irradiated Th is presented. The irradiated mass is dissolved in HNO_3 and a concentrated aqueous solution is formed wherein the $Th(NO_3)_4$ is present in a ratio by weight of $Th(NO_3)_4$ to H_2O of approximately 1:1. The U, however, is present in con-

centration of less then 1% that of the Th. This aqueous solution is then extracted with ether which preferentially takes up 70 to 80% of the U present and only 0.5% of the Th. (auth)

6998

PROCESS FOR RECOVERY OF URANIUM FROM AQUEOUS SOLUTIONS. J. W. Gates, Jr. and L. J. Andrews (to U. S. Atomic Energy Commission). U. S. Patent 2,780,518. February 5, 1957.

A method is described for the recovery of U from aqueous solutions in which the U is accompanied by F^- The method is particularly useful in connection with organic solvent extraction of U, and is effective in neutral or acidic solutions. It consists of incorporating Al^{3+} in the solution, in order to complex the F^- present. The Al concentration should preferably be sufficient to provide an atomic ratio of Al to F^-, of one to one. (auth)

6999

RECOVERY OF URANIUM FROM ORES. D. Kaufman and S. E. Bailey (to U. S. Atomic Energy Commission). U. S. Patent 2,780,519. February 5, 1957.

A process is described for recovering U from acid leach liquors containing high concentrations of silicates, Fe and Al and relatively little U. The recovery is effected by treating the leach liquors with a metallic reducing agent, e.g. Fe, to obtain the dissolved U as U^{4+}, and then adding a water soluble phosphate to effect the selective precipitation of uranous phosphate. This precipitate may then be treated with an alkali metal hydroxide to convert the uranous phosphate to uranous hydroxide. (auth)

7000

URANIUM SEPARATION PROCESS. R. M. Hainer and E. C. Evers (to U. S. Atomic Energy Commission). U. S. Patent 2,780,532. February 5, 1957.

A process is described for separating U from aqueous solutions in which it is accompanied by other metals, chiefly Fe, Ni and Cu. A dialkyl ether of a polyethylene glycol is used as an extracting agent after large quantities of NO_3^- have been added to the solution to affect salting out of $UO_2(NO_3)_2$. Under these conditions it has been found that the organic phase will extract approximately 98% of the U but will not extract appreciable amounts of any of the other metals present. $Ca(NO_3)_2$ and $NH_4(NO_3)$ are mentioned as being effective salting out agents. (auth)

7001

STILL COLUMN WITH CONCENTRIC CONDENSER. A. K. Brewer and T. I. Taylor (to U. S. Atomic Energy Commission). U. S. Patent 2,780,589. February 5, 1957.

A countercurrent reflux still is described which may be used in high vacuum or molecular distillation comprising an inclined still column in combination with an internal condensing and reflux device. The cooled side of the column is constructed as a series of inclined surfaces sloping in a direction opposite to the general direction of flow of liquid along the heated surface. Increased heat efficiency and greater temperature control of the heated and cooled surfaces are obtained with the disclosed still. (auth)

7002

ELECTRODEPOSITION OF URANIUM. H. A. Wilhelm and D. H. Ahmann (to U. S. Atomic Energy Commission). U. S. Patent 2,781,304. February 12, 1957.

A process for the electrodeposition of metallic U from fused uranium halide baths is given. It has been found that the U in the bath may be furnished by using an anode of UC_2. Alternatively the UC_2 may be placed in contact with, or adjacent to the anode whereby the UC_2 is broken down and the U dissolved. The electrolyte is a fused uranium alkali halide or a mixture of such halides. (auth)

7003

PROCESS OF RECOVERING URANIUM FROM SOLUTION. Robert Q. Boyer and Scott B. Kilner (to U. S. Atomic Energy Commission). U. S. Patent 2,781,303. February 12, 1957.

An electrolytic process is described for recovering U from calutron wash solutions in which it is accompanied by ionized Ni, Fe, Cr and Cu. The process employs a cell with an anode compartment, a cathode compartment, and a mercury cathode. An aqueous acid solution is the catholyte and the U containing solution is the anolyte. Upon electrolysis the U and other metallic ions migrate to the catholyte. The impurities are reduced and amalgamated with the mercury cathode while most of the U remains dissolved. The catholyte is continuously removed and the U recovered therefrom, and the depleted anolyte is continuously withdrawn, concentrated and recycled. (auth)

7004

URANIUM RECOVERY PROCESS. John J. Brunner (to U. S. Atomic Energy Commission). U. S. Patent 2,782,091. February 19, 1957.

A method is given for recovering U from the low U content hydroxide residues obtained from low grade ores. The recovery is accomplished by digesting the residues with H_2SO_4 at a pH of 3 to 3.8 and at a temperature of 68 to 100°C for at least an hour. The U is selectively extracted into solution by this digestion. The U is then precipitated from the acid solution by the addition of H_2O_2. (auth)

7005

RECOVERY OF METALS SALTS FROM MIXTURES. W. V. Wirth and D. X. Klein (to U. S. Atomic Energy Commission). U. S. Patent 2,782,092. February 19, 1957.

A method is presented for the separation of UF_6 from certain volatile halogenated hydrocarbons. The separation is accomplished by hydrolyzing the UF_6 to UO_2F_2 in an aqueous medium and then separating the water insoluble fluoro hydrocarbons therefrom by decanting or distillation. Since conducting the hydrolysis in an acid solution results in the formation of corrosive HF it is preferred to carry out the hydrolysis an alkaline or neutral medium. (auth)

7006

METHOD OF PREPARING METALS FROM THEIR HALIDES. F. H. Spedding, H. A. Wilhelm and W. H. Keller (to U. S. Atomic Energy Commission). U. S. Patent 2,782,116. February 19, 1957.

A method is given for the production of Th from its halides. The method consists in reducing ThF_4 by reaction with an alkali metal or alkali earth metal, particularly Ca. An additional feature is the admixture with the reaction mass of $ZnCl_2$. The $ZnCl_2$ is reduced by the Ca, and the Zn forms with the Th a metal mixture which melts below the melting point of the Th. The Zn can later be distilled away from the Th, allowing recovery of pure Th. (auth)

7007

METHOD OF RECLAIMING URANIUM. H. A. Wilhelm and C. F. Gray (to U. S. Atomic Energy Commission). U. S. Patent 2,782,117. February 19, 1957.

A method is given for reclaiming waste U filings, turnings and metal scrap. The scraps are sorted to separate large pieces of foreign matter and then cut up. During this cutting step a coolant liquid, 3% Na_2SiO_3, is provided which also acts as a degreasing and cleaning agent. The U pieces are then washed, sorted again and briquetted. The inclusion of about 0.1% of an alkali metal or alkali earth metal, for example Mg, to the briquetting mixture substantially improves the yield of U. (auth)

7008

SEPARATION OF URANIUM FROM OTHER METALS BY HYDRIDING. T. A. Butler (to U. S. Atomic Energy Com-

mission). U. S. Patent 2,785,046. March 12, 1957.

A method is given for separating U from other metals with which the U is alloyed. The method consists in selectively hydriding the U by contacting the alloy with H_2 at a temperature between 200° and 300°C and a pressure of from 3 to 150 millimeters. The unhydrided metal phase consisting mainly of Pu and either Sn, Au, Ag or Cu is then separated from the U by dissolution in a nonoxidizing mineral acid, e.g. 2N HCl. (auth)

7009

METHOD OF SEPARATING PLUTONIUM FROM CONTAMINANTS. H. S. Brown and O. F. Hill (to U. S. Atomic Energy Commission). U. S. Patent 2,785,047. March 12, 1957.

A method is presented for separating Pu from fission products, and for obtaining the Pu in a concentrated form. Irradiated U is dissolved in HNO_3, and a LaF_3 precipitate, which carries the Pu and the fluoride soluble fission products, is formed in the solution. The present invention comprises reacting this dried precipitate with HF whereby fission products which form relatively volatile fluorides are volatilized away from the Pu-containing LaF_3 mass. The mass is then treated with anhydrous F_2 at elevated temperatures whereby the Pu is oxidized and volatilized as its higher fluorides, and is thus separated from the LaF_3 and other less volatile constituents of the mass. (auth)

7010

BISMUTH PHOSPHATE PROCESS FOR THE SEPARATION OF PLUTONIUM FROM AQUEOUS SOLUTIONS. S. G. Thompson and G. T. Seaborg (to U. S. Atomic Energy Commission). U. S. Patent 2,785,951. March 19, 1957.

A method is given for separating Pu from fission products arising with it in the irradiated U. The method makes use of the fact that Pu^{6+} forms a soluble phosphate while lower valent plutonium forms an insoluble phosphate. The irradiated U is dissolved, Bi ion is added to serve as a carrier, and while the Pu is being maintained in its lower valent state, PO_4 is added, causing the precipitation of the Pu and any fission products which form insoluble phosphate. This precipitate is filtered out and then redissolved in an aqueous acid solution. The Pu is then oxidized to the higher valent state causing it to remain in solution when phosphate ion is added to precipitate out the phosphate insoluble fission products which accompanied the plutonium in the first precipitation. (auth)

7011

PREPARATION OF URANIUM METAL. C. H. Prescott, Jr., and J. A. Holmes (to U. S. Atomic Energy Commission). U. S. Patent 2,785,972. March 19, 1957

A method is given for production of high purity U by decomposing volatile UI_4 on a hot refractory surface. Iodine vapors are passed over solid UI_3 and the UI_4 thus formed is passed over a series of tungsten filaments heated to a temperature above 800°C but below the melting point of U. The UI_4 decomposes depositing pure U on the hot tungsten filaments. The process is carried out in a sealed and evacuated apparatus. (auth)

7012

PREPARATION OF FLAVONOID GLUCOSIDES. S. H. Wender and D. W. Fox (to U. S. Atomic Energy Commission). U. S. Patent 2,786,832. March 26, 1957.

A method is described for the preparation of flavonoid glucosides from their corresponding flavonoid rhamnoglucosides. This is accomplished by reacting formic acid with a solution of the flavonoid rhamnoglucoside in an aliphatic alcohol, particularly cyclohexanol. Temperature conditions are not critical although refluxing is usually satisfactory. The flavonoid glucoside reaction product is then recovered according to known methods. (auth)

ENGINEERING

7013

VACUUM GAUGE. G. A. Kuipers (to U. S. Atomic Energy Commission). U. S. Patent 2,780,099. February 5, 1957.

A vacuum measuring device comprising a vane pivotally mounted adjacent a wall within a test chamber is described. An opaque member attached to the vane generates a pulsating current in a photoelectric circuit. The current is supplied to a loop secured to the vane and acts with a magnet to maintain constant, the frequency of oscillation of the vane. The electrical power supplied to the loop is a measure of the pressure, due to the damping effect of the gas between the wall and vane. (auth)

7014

PUMP CYLINDER ASSEMBLY. J. Entwistle (to U. S. Atomic Energy Commission). U. S. Patent 2,782,081. February 19, 1957.

A pump cylinder assembly is described for use where considerable differential pressures exist on opposite sides of the sealing means. The assembly comprises a cylinder head, liner, and clamping means and is simpler in construction than the cylinder assembly using gaskets. A cylinder liner is clamped securely to a cylinder head. Mating ledges on a clamping ring and the liner act to tightly clamp the liner and cylinder head together. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

7015

METHOD OF SEPARATING URANIUM FROM ITS ORES. A. H. A. Ross, R. H. Farmer and A. G. W. Lamont (to U. S. Atomic Energy Commission). U. S. Patent 2,639,974. May 26, 1953.

A smelter process is described for obtaining a high content product from U ore concentrates, and is intended to replace the H_2SO_4 leaching of these concentrates. The process consists of fusing the U concentrates with lime and coke, whereby a slag is formed which contains substantially all of the U and which does not contain S, As or most of the various base metals present in the ore. Approximately 8 parts of coke and 30 parts of lime are used for every 500 parts of ore concentrates. The smelter product is soluble in HNO_3. (auth)

7016

URANIUM SEPARATION PROCESS. A. Thunaes, E. A. Brown, H. W. Smith and J. Brannen (to U. S. Atomic Energy Commission). U. S. Patent 2,738,253. March 13, 1956.

An acid leaching process for obtaining uranium from its low grade ores and complex ores is described. The ore is ground and agitated with a solution of $NaClO_3$ in weak H_2SO_4. The ClO_3^- is present to convert all U present to U^{6+} so that it will not be precipitated by PO_4^{3-} which is present in the ore. The process is carried out at a pH of less than 2.1. (auth)

7017

APPARATUS FOR VACUUM CASTING OF URANIUM. C. F. Gray and H. A. Wilhelm (to U. S. Atomic Energy Commission). U. S. Patent 2,782,475. February 26, 1957.

An improved apparatus for the vacuum casting of U slugs or biscuits is described. The apparatus consists of a mold, supporting, and joined to a crucible containing a melting chamber. The crucible and mold are connected by an aperture, the aperture is closed by a plug, and the plug is connected to a push rod adapted to move the plug and open the aperture from outside the apparatus. The assembly is covered by a shield resting on, and hermetically sealed to a

refractory base, allowing the production of a vacuum within the apparatus. An induction heating coil surrounds that portion of the apparatus containing the melting chamber. (auth)

7018

SEPARATION OF URANIUM FROM OTHER METALS BY HYDRIDING AND EXTRACTION WITH OXIDIZING REAGENTS. J. H. Carter and T. A. Butler (to U. S. Atomic Energy Commission). U. S. Patent 2,784,054. March 5, 1957.

A method is given for separating U from other metals with which the U is alloyed. The method consists in selectively hydriding the U by contacting the alloy with H_2 at a temperature between 200 and 300°C and a pressure of from 3 to 150 mm. The unhydrided metal phase consists mainly of Pu and either Sn, Au, Ag or Cu. The uranium hydride is separated from this phase by treatment with a solvent which selectively converts the uranium hydride to a soluble state. (auth)

7019

ZIRCONIUM TERNARY ALLOYS. L. L. Marsh, Jr. and W. Chubb (to U. S. Atomic Energy Commission). U. S. Patent 2,784,084. March 5, 1957.

A group of Zr–Nb ternary alloys are described which contain from 1% to 5% by weight of Nb and from 0.1% to 2% by weight of either Al, Mo or V. These alloys have low neutron capture cross sections, together with superior tensile characteristics at high temperatures and desirable ductility. Mentioned as outstanding in possessing these properties is the specific alloy containing 1.5% Nb and 1.0% Al, with the balance being Zr. (auth)

7020

METHOD OF FORMING CRUCIBLES AND REACTION CHAMBERS FOR PRODUCTION OF URANIUM OF HIGH PURITY. H. A. Wilhelm (to U. S. Atomic Energy Commission). U. S. Patent 2,785,064. March 12, 1957.

A method is given for forming a refractory lining for the reaction chamber or bomb in which alkali earth metal reduction of U halide is carried out. The method comprises inserting a form or mandrel into the chamber such that a uniform narrow space is left between the mandrel and chamber wall on all sides. This space is filled with anhydrous CaO powder. Instead of being tamped or compressed as it is added, the powder and reaction chamber are jolted until the powder has settled into a dense mass. (auth)

7021

METHOD OF PRODUCING METALS FROM THEIR HALIDES. F. H. Spedding, H. A. Wilhelm and W. H. Keller (to U. S. Atomic Energy Commission). U. S. Patent 2,785,065. March 12, 1957.

A method is given for the production of metallic Be from its halides. The method consists in reducing the Be halide, usually BeF_2, by reaction with an alkali metal or alkali earth metal preferably with a mixture of Ca and Mg. An additional feature, is the admixture, with the reaction mass, of some substance such as S, I_2 or an oxidizing salt, capable of an exothermic reaction with the reducing metal. This is done in order to develop a temperature higher than the melting point of the metal being produced. (auth)

PHYSICS

7022

COMBINATION OF ACCELERATION SENSING AND INTEGRATING MEANS. H. F. Devaney (to U. S. Atomic Energy Commission). U. S. Patent 2,780,455. February 5, 1957.

A device combining acceleration sensing and integrating means in a rugged and reliable construction is described. A hair spring connected to a shaft with an acceleration responsive balance member controls the oscillation frequency of an escapement member, to thereby control movement of a train of gears. An output wheel with electrical contact means is geared to the train so that a change in acceleration varies the time before an electrical circuit is closed. (auth)

7023

TEST EXPONENTIAL PILE. Enrico Fermi (to U. S. Atomic Energy Commission). U. S. Patent 2,780,595. February 5, 1957.

A nuclear fission test pile is described which is designed to measure the fissioning chain reaction induced in a subcritical mass of natural U by a neutron source. The pile comprises a number of cells containing natural U, disposed in a graphite moderator, and adjacent to an independent source of neutrons for the purpose of causing in the test pile a chain reaction that cannot be self-sustaining. Measurements are made of the radioactivity induced in strips of indium foil which are inserted in appropriate slots or channels in the core. This pile permits the taking of such measurements from a reactor requiring a reduced amount of valuable material, and eliminates the possibility of a dangerous buildup of reactivity. (auth)

7024

NEUTRONIC REACTOR. G. A. Anderson (to U. S. Atomic Energy Commission). U. S. Patent 2,780,596. February 5, 1957.

The design structure is given for a reactor core incorporating hexagonal fuel channels, in which fuel plates, supported and separated by frames, are inserted. A metallic Be reflector is situated about the core to intensify the neutron density within the contained space. Breeding channels are also contained in the reflector so that further material such as Th may be converted into a fissionable U isotope. The fuel and cooling channels are designed so that a maximum of heat may be extracted for conversion into power. This reactor design therefore combines an efficient production of useful heat with the facility for breeding fissionable U from Th. (auth)

7025

APPARATUS FOR THE MEASUREMENT OF NEUTRON ABSORPTION. E. P. Wigner (to U. S. Atomic Energy Commission). U. S. Patent 2,781,307. February 12, 1957.

An apparatus designed to measure the unknown neutron absorptive properties of a substance is described. This is accomplished by the cyclic insertion and removal of the sample substance from a reactor core. The power level of the reactor varies with the same frequency as the positioning of the sample relative to the core. The fluctuation of the power level can be measured by suitable means such as an ionization chamber, which is then compared with the fluctuation caused by the positioning of a sample with known neutron absorptive properties, and a comparison or relative measurement of the unknown properties may be determined. (auth)

7026

NEUTRONIC REACTOR CONTROL. E. C. Creutz and W. H. Zinn (to U. S. Atomic Energy Commission). U. S. Patent 2,781,308. February 12, 1957.

A reactor control system comprising tubular control rods is described. The tubular rods contain a material having a danger coefficient of at least 100 enclosed in inner and outer protective tubes of a material having a danger coefficient less than 10. (auth)

7027

RADIATION SYSTEM. J. S. Levinger et al. (to U. S. Atomic Energy Commission). U. S. Patent 2,781,309. February 12, 1957.

An apparatus is described for utilizing as a neutron source the delayed neutron obtained in fission at places remote from a primary source of neutrons. A section of a closed fluid circulating system containing fissionable material is bombarded by neutrons at one point in this circuit. The delayed fission neutrons are then used at another point in the system. (auth)

7028

GATING CIRCUIT. W. C. Struven (to U. S. Atomic Energy Commission). U. S. Patent 2,781,448. February 12, 1957.

A gating circuit utilizing two vacuum tubes and a pair of crystal diodes is described. A gating signal applied to the control grid of each tube concurrently with input signals varies the potential of the output terminal of the circuit in proportion to the input signal, within the limits of the gating signal. (auth)

7029

ION BEAM RECEIVER. E. J. Lofgren and F. Fairbrother (to U. S. Atomic Energy Commission). U. S. Patent 2,781,452. February 12, 1957.

A probe is described which is used to ascertain the electrical current value of an accelerated particle beam independent of the usual current influencing factors, such as secondary charge on the probe. The power absorbed by the collector cup is determined by measuring the electrical power required to heat the collector cup to the temperature assumed when the beam impinges. Beam current is computed using the electrical power absorbed and the accelerating potential in the electrical power equation. (auth)

7030

NEUTRONIC REACTOR. J. A. Wheeler (to U. S. Atomic Energy Commission). U. S. Patent 2,782,158. February 19, 1957.

The structural arrangement of the core for a nuclear reactor with improved cooling and heat extraction is described. A graphite tube containing reactor fuel is seated in an opening through a stack of several graphite bricks, each opening having oppositely disposed side cut-outs. Slits through the tube provide gas passages to and from the fuel elements within the tube. The coolant passes through one cut-out passage to the tube center by way of the slits, and is removed from the core via an opposite tube slit and the other cut-out passage. Constriction of the intake cut-out passage and appropriate slit positioning are ways of varying the heat absorbed along the length of the fuel tube. (auth)

7031

FOLLOW-UP MECHANISM. H. V. Lichtenberger and L. J. Koch (to U. S. Atomic Energy Commission). U. S. Patent 2,782,941. February 26, 1957.

An apparatus is described for withdrawing a control rod from a reactor core and reinserting it without the rod sticking or becoming jammed as it returns. An improved electromagnet, when energized, locks to a magnetic head on the control rod. A motor through a rack and pinion assembly lifts the control rod from the core. Insertion of the control rod is effected by de-energizing the magnet, dropping the rod. The control rod is driven positively into the core by the motor when a switch tripped by the falling control rod reverses the motor. (auth)

7032

PRESSURE SWITCH. A. F. Fink (to U. S. Atomic Energy Commission). U. S. Patent 2,783,320. February 26, 1957.

An instrument is described for indicating the occurrence of an overpressure. Two conducting domes are mounted concentrically and spaced from one another so that a pressure sufficient to crush the outer dome will cause it to make contact with the inner dome, thus closing an electric circuit connected between the two domes. The novel pressure indicator responds to the positive application of pressure, not to the stresses created in the member to which it is secured. (auth)

7033

AUTOMATIC CONTROL SYSTEM WITH REMOTE ADJUSTMENT. W. H. Appleton and G. M. Farly (to U. S. Atomic Energy Commission). U. S. Patent 2,782,993. February 26, 1957.

An apparatus for remote control and adjustment of an automatic temperature system is described. A manually adjustable resistance located at a remote point is arranged to unbalance a bridge circuit. The difference between the selected temperature and the temperature within the heated area is indicated on a calibrated voltmeter at the remote point. (auth)

7034

HIGH SPEED POSITIVE PULSE GENERATOR. W. A. Ha... (to U. S. Atomic Energy Commission). U. S. Patent 2,783,376. February 26, 1957.

An improved pulse generating circuit for exciting a Ker... cell employed as a shutter on a high-speed camera is described. The novel feature of the circuit is the use of two control bias tubes to provide a low impedance return circuit for the control grids of a parallel triggered blocking oscillator, while allowing high resistance direct current paths for biasing potentials. Output pulses of substantial amplitude with a base width of less than one microsecond and internal spacing of the order of microseconds are obtained with this circuit. (auth)

7035

REGULATED POWER SUPPLY. W. R. Baker (to U. S. Atomic Energy Commission). U. S. Patent 2,783,433. February 26, 1957.

An improved voltage regulated power supply is described which provides a d-c output voltage substantially independent of frequency and wave shape, or of change in the characteristics of the supply components. A voltage dividing network across the output terminals of a d-c supply comprises two resistors in series connected between the terminals with a capacitor in parallel with each resistor, the time constant of each RC combination being the same. A fraction of the output voltage is obtained from the divider and controls the voltage amplitude of a rectified radio frequency signal. This voltage adjusts the drop across a conventional series voltage regulator tube. (auth)

7036

GAS RECOVERY SYSTEM. John Ise, Jr., and George P. Millburn (to U. S. Atomic Energy Commission). U. S. Patent 2,784,799. March 12, 1957.

A gas recirculation system is described in which a valuable isotope, exhausted from a cyclotron diffusion pump is recompressed and piped through a filter which removes all substances foreign to the desired isotope. The purified gas is further recompressed and recirculated to the ion source where the isotope is reionized and reaccelerated. This recirculation system will permit the recovery and reuse of an otherwise prohibitively expensive material. (auth)

7037

PULSE HEIGHT ANALYZER. A. E. Larsh, Jr. and A. Ghiorso (to U. S. Atomic Energy Commission). U. S. Patent 2,784,910. March 12, 1957.

A multi-channel differential pulse height analyzer is described for sorting pulses from a radiation detector ac-

cording to the magnitudes thereof. A plurality of pulse channels receive pulses from a single source. Each channel has a multivibrator section which responds to a different pulse amplitude, and in turn operates an electromechanical register. Operation of only the channel corresponding to the maximum value of the input pulse is accomplished by blocking the channels responsive to lesser amplitudes. (auth)

7038

LOW VOLTAGE ION SOURCE. E. O. Lawrence (to U. S. Atomic Energy Commission). U. S. Patent 2,785,311. March 12, 1957.

An improved generator is described for the production of a very high current ion beam. Electrons emitted from a cathode are directed by a magnetic field into a region of an arc discharge, where they bombard gas molecules. Ions formed in the region are drawn out by means of several negatively charged electrodes. The electrodes are curved and nested in parallel relationship and have apertures aligned to form a narrow high current ion beam from the several low current beams passing through electrodes. (auth)

7039

SOURCE UNIT FOR PRODUCING IONIZED GAS. L. Ruby, R. B. Crawford and W. Pon (to U. S. Atomic Energy Commission). U. S. Patent 2,786,143. March 19, 1957.

A device is described for producing a space charge neutralized ion cloud which can be repetitiously operated, eliminates the use of an external gas supply, and results in negligible coincident contamination by neutral gas molecules or associated electron beams. The source unit comprises a plurality of interleaved occluded-gas metallic discs and insulating spacers. The neutral ion cloud is generated by establishing an electrical arc discharge between the peripheral surfaces of the metallic discs for a specific interval. (auth)